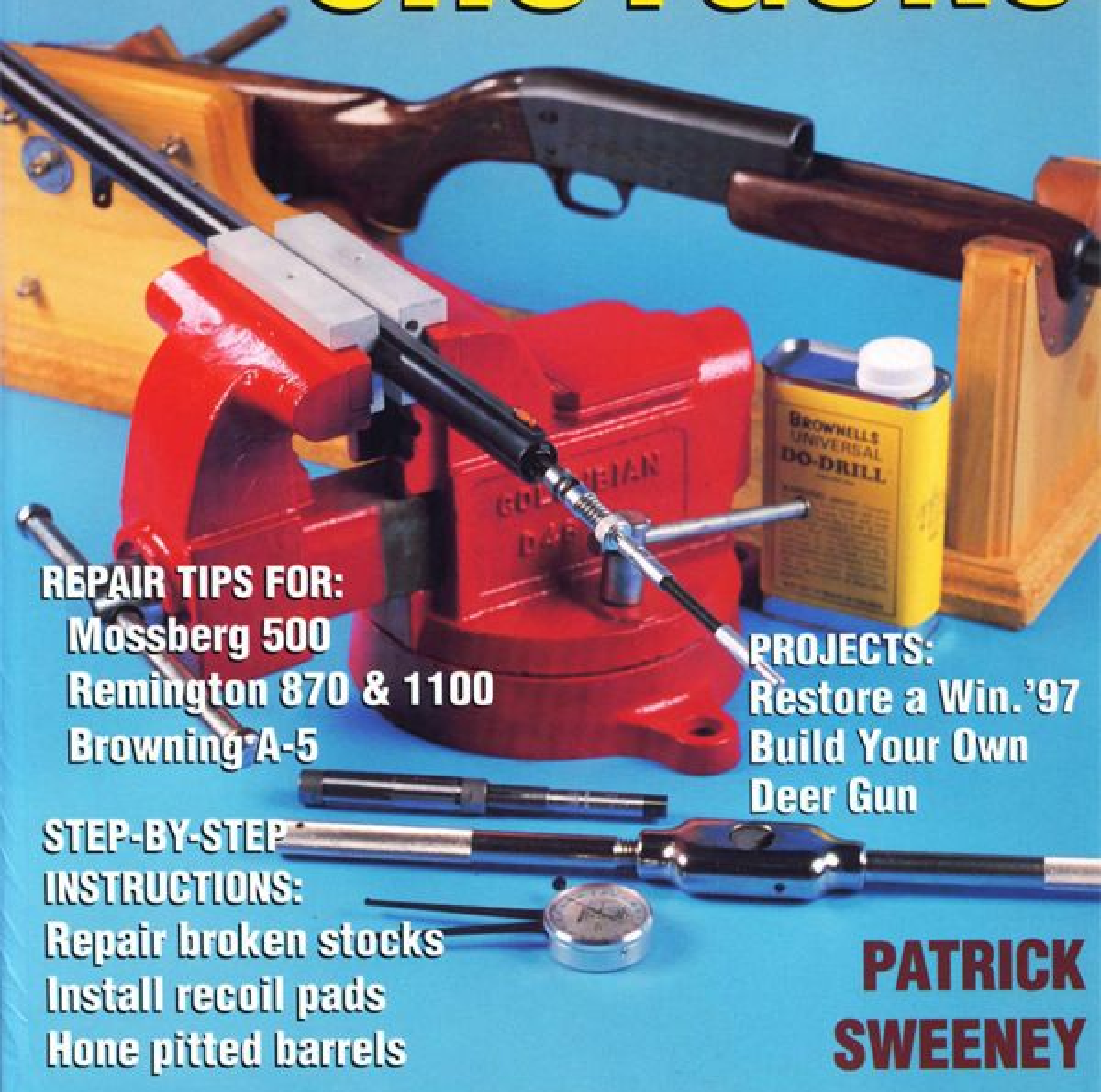
GUNSMITHING: SHOTGUNS



REPAIR TIPS FOR:
- Mossberg 500
- Remington 870 & 1100
- Browning A-5

PROJECTS:
- Restore a Win.'97
- Build Your Own Deer Gun

STEP-BY-STEP INSTRUCTIONS:
- Repair broken stocks
- Install recoil pads
- Hone pitted barrels

PATRICK SWEENEY

GUNSMITHING SHOTGUNS

PATRICK SWEENEY

Published by

krause publications
700 East State St., Iola, WI 54990-0001

eISBN: 978-1-44022-448-5

715-445-2214

www.krause.com

Please, call or write us for our free catalog of antiques and collectibles publications. To place an order or receive our free catalog, call 800-258-0929. For editorial comment and further information, use our regular business telephone at (715) 445-2214

Library of Congress Catalog Number: 00-104631
ISBN: 0-87341-902-0

Printed in the United States of America

Acknowledgments

Writing a book that consists of more than a collection of memoirs requires assistance. In the case of a book on gunsmithing, writing requires the help of other gunsmiths, the manufacturers and suppliers, and the forbearance of the editor. I would like to thank my fellow gunsmiths for their help through the years and on this book. I would also like to thank the manufacturers for their kind loan of shotguns, ammunition, tools and parts. As for my long-suffering editor, I hope that Kevin has found a 200-yard range at which to soothe his frustrations.

Dedication

I think it was H.L. Mencken who described writing as "… sitting at a typewriter and staring at a blank sheet of paper until beads of blood form on your forehead, fall off and form words." I laughed the first time I read it. I didn't laugh the first time I found myself sitting at a typewriter at 2 a.m., unable to write anything worth sending off in the morning mail to make the deadline. That was in 1987. However, writing, and being a writer, are two different states. I will forever be in debt to Felicia for kicking me from writing to being a writer. I only thought I knew the language before reading what she can write, and for what she has done to improve my writing. Thanks, Felicia, "Had I a hat, off it would be."

The Author

Patrick Sweeney lives in the Midwest, writing and teaching, and traveling to various exotic locales to shoot and teach. While many consider the job of a gun writer to be a dream come true, he just wants you to know that the grind of shooting mountains of ammunition, traveling to Paris to view the museum at Les Invalides (and stopping off in Liege to see the FN factory) are not as fun as they might seem. They are a lot more fun. Stay tuned for more episodes.

Foreword

If you've ever looked at a malfunctioning shotgun and said, “I can fix that,” this book is for you. If you've ever looked at an ugly shotgun and said, “I can spruce that up a bit,” keep reading. Gunsmith Patrick Sweeney has again added to the collective knowledge of hobby gunsmiths everywhere. Gunsmithing Shotguns, provides the insight and the details to give you the confidence to work on your own shotgun. Whether you hunt upland birds, waterfowl, turkey or deer, this book has something that will make your life easier. The same is true if you use your shotgun for competitive sport shooting. Sweeney's years of experience at the gunsmithing bench have been translated into easy-to-read text and augmented with clear, instructional photos. Read this book, practice the skills presented here and you will be able to work on your shotgun. Just that simple.

Kevin Michalowski
Firearms Book Editor
Krause Publications.

Table of Contents

Introduction

The shotgun has been with us ever since somebody got the bright idea of using gunpowder to launch a projectile. Ever since then, we have been struggling with the same questions. How big? How heavy? How to make the damned thing hit where I want it to? When smoothbores were the only guns available, a lot of time and energy went into perfecting them. What a lot of shooters today don't realize is just how far those efforts went. We think of a muzzle-loading firearm as a curiosity, or another way to get more hunting time. It couldn't compare to a modern shotgun, rifle or handgun could it? Don't bet on it.

A muzzle-loading rifle can be quite powerful, enough to handily kill any big game. A smoothbore can be accurate. When dueling was fashionable, rifling in a dueling pistol was not allowed. However, gunsmiths could so precisely bore the barrel, and make molds for bullets to match them, that one English nobleman who practiced (a rarity then and now, someone who actually practices) bragged he could “hit a silver dollar a 20 paces every time.” Want to duel against him? Neither did anyone back then. And unreliable flintlocks? At the pinnacle of their design and manufacture, a lockmaker could make a flintlock “proof against rain, and sure in function.”

Shotguns were close-range hunting and defense weapons that threw a lot of pellets. A duck centered by an ounce of No. 4 shot can't tell whether the shot came from a muzzle-loader at 20 yards or a modern “thunderstick” at 50. Confusion over the proper design and use for a shotgun didn't come up until rifles had supplanted them as general-purpose tools. Once rifles took over as the main hunting tool, and the main military personal weapon, shotguns were defined more by what they lacked than what they had. Shotguns were rifles without rifling. Even though hunters don't aim much (just watch them shoot) many feel that aiming is the only way to shoot. The idea of a cloud of shot sweeping their quarry from the sky is too peculiar. Others take the idea of a “cloud of shot” too much to heart, and assume that if they throw lead up, ducks fall down. Shotguns work differently than rifles, and if you do not understand the difference, you will be frustrated with any shotgun.

Without a dominant position, the shotgun found itself being forced into many secondary roles. “It's a duck gun.” “It's an alley-sweeper.” “Its a slug-

throwing deer gun." Well, it is all of those but not all at once. Many advocates feel that the shotgun and a selection of ammunition is the most versatile firearm going. However, unless you have all of the ammo selections at hand, and the time to make a choice, the versatility is theoretical.

Even the U.S. Army has tried to make the shotgun into something it isn't. Enamored of the idea of multiple shot payloads, but not satisfied with the durability, range or penetrating power, they have tried to "improve" the shotgun. The goal is to create a weapon that will give a near 100 percent certainty of hits at 100 meters, the ability to penetrate body armor and chance obstacles, and has quick-reloading capabilities. As any capable shotgun shooter or gunsmith could tell them, the Army ended up with a weapon that was larger than and nearly as heavy as a light machinegun, had heavy recoil, and a limited magazine capacity. The Army isn't alone in trying to force-fit the shotgun into new jobs. Law enforcement agencies have struggled with the role of the shotgun, from a "can't miss alley sweeper" to a weapon issued only on raids, to a launching device for tear gas and pepper spray.

If the idea of a "wonderweapon" is out, what can you make a shotgun do? A lot, but not all in the same shotgun. If you want a shotgun that can pull ducks and geese down out of the sky, great. We can do that. Just don't expect the same shotgun to go out the next weekend and bag a buck at 100 yards with a slug load. Anything you do to make a shotgun, or any firearm, better suited for one purpose, you risk making it less suited for another. One example would be goose hunting and quail hunting. The goose hunter needs to launch heavy payloads at brisk velocities to relatively high altitudes. The cost of this performance is recoil. He can reduce felt recoil by making the shotgun heavier, which also smoothes his swing. By using a longer barrel he gets a more precise lead on the distant birds. Take that same shotgun with its 3-½-inch magnum shells and 30-inch barrel out after quail and you'll give up before lunch. Even if you can tote the weight, maneuvering the long barrel through the thickets and around the brush is frustrating work. And when you do kick up a bird, getting that heavy gun to point in the right direction before the bird is gone may be impossible. Sure, you can switch from the magnums to light loads, but the shotgun is still a ponderous tool. But a suitable quail gun that weighs less than 7 pounds with a 22-inch barrel is one the geese will laugh at.

Many states, and parts of other states, require shotguns-only for deer hunting. Neither the goose gun nor the quail gun will serve you well for deer hunting. While the recoil of slug loads can approach that of goose loads, you don't need the weight or size of the goose gun. You need better sights than either the goose or quail gun have. If you mount a scope on your deer hunting shotgun, you may have to alter at replace the stock for a higher comb so you can get a good check weld. With the higher comb on, and a non-scoped barrel back in place, you may not be able to get your face down far enough to properly see the bead. Your deer shotgun may need more than just an extra barrel, and you will need the proper wrenches or screwdrivers to replace the stock each time you switch.

You don't need high magazine capacity or rapid-fire for any of these uses. For a defense shotgun, utter reliability is paramount. Then, you need rapid follow-up shots and ease of reloading the shotgun. While a side-by-side shotgun is almost required for Cowboy Action Shooting and very useful for hunting and clay pigeon games, I would not pick it first for defense. Not that I would feel naked if it was all I had, but it wouldn't be my first choice. (Actually, my first choice is dialing 9-1-1 and waiting for assistance, but that is another book.)

The shotgun can be a versatile firearm, but do not try to make it do too many things at once. I will be showing you how to fix and upgrade many shotguns for quite a few situations. When you are planning to work on your shotgun, remember that you can't make one do the job of many. The more you specialize the more you will need another shotgun to fill the roles your modifications preclude. If you want to use this as a pretext for buying and owning more shotguns, go right ahead. Just don't expect me to get in the middle and mediate if you go overboard and your significant other objects.

At almost every turn while describing how to do this or that procedure, I will start out by saying some variant of: “Make sure it isn't loaded.” It may seem nanny-like, and you may bristle at the constant reminder. In years of working as a commercial gunsmith, I saw quite a few loaded guns brought in for sale, trade or repair. In every case, as we were going to check it, the owner would invariably say “Oh, it isn't loa……” The ammo rattling off the counter and onto the floor was always a sure conversation stopper. I have had one accidental discharge in my life, and it happened when I knew for a certainty that the revolver I was handling was loaded. I let myself get

distracted for a moment, and the range rail I was standing at acquired a new hole as a result.

The result of that accident was a moment of embarrassment, and memory for a lifetime. If you don't check the loaded status of that shotgun you are handling, the results could very well be more than embarrassing, possibly even a nightmare for a lifetime. It takes a moment to check, and is the mark of a competent shooter to check each time. If you don't already do it, get into the habit.

When it comes to what work you can and “should” do, and how many shotguns you need to enjoy your sport, I'll just tell you “why and how” and will leave the rest to you. Have fun and stay safe.

Patrick Sweeney

Chapter 1
History

Black powder was invented in China 1,000 years ago, but its first appearance in Europe came in 1313 by the hand of Friar Berthold Shwartz. Others may have developed it earlier, but they left no record, perhaps an inadvertent outcome of the discovery. (A valuable lesson: if you want to get credit, or prevail in the patent lawsuit, take good notes.) Reading about the first uses of gunpowder, and the “gonnes” it was used in, is enough to raise the hair on the back of your neck. The barrels were just that, barrels, made of wooden staves strapped into a tube. The “powder” was simply a mixture of the three ingredients of black powder, charcoal, sulphur and salt petre (potassium nitrate). After shoveling in an “appropriate” amount of their favorite mixture, the gunners would load the projectile, point the gonne in the direction of the enemy, and apply a torch or smoldering ember to the touch-hole.

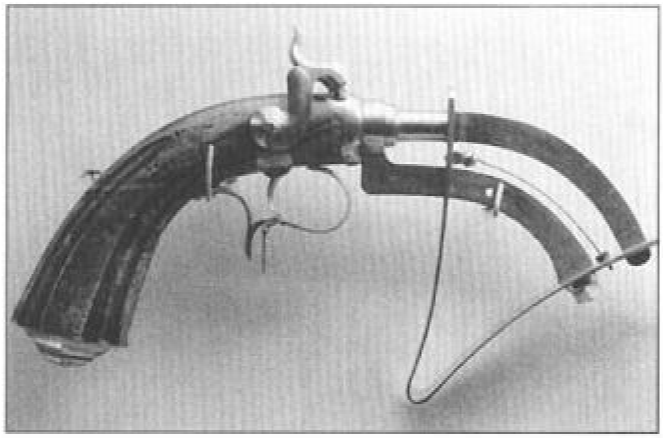
The barrels split often enough that both sides of the fray kept a safe distance. Rifling, what rifling? After all, how can you rifle a wooden tube, what good would it do when the “bullet” is a stone? You really had to dislike someone to go to all that effort for not much gain. Despite all the shortcomings, the advantages were great. In 140 years, the use of “gonnes” had advanced to the point that the Ottoman Turks were using them to batter down the walls of Constantinople.

There were a whole lot of technical difficulties that had to be attended to before rifling and rifles would have any utility except in a siege. Among them were uniformity of powder, precision measuring systems and mass-production methods. While improvements in firearms technology increased the usefulness of rifles, and insured that rifles would replace shotguns (or “smoothbores” as many prefer) in many applications, improving firearms technology also improved shotguns. In order for rifles to work, the rifling must uniformly engage the bullet the length of the barrel. A rifle barrel must be reamed and polished smooth, straight and even before it can be rifled, or the result will be an inaccurate barrel. The same methods applied to a shotgun barrel produce a more-uniform barrel that delivers consistent groups.

This is a shotgun. Albeit a large shotgun, but a smoothbore none the less. Even when bronze gun tubes had been perfected, being on an artillery crew was dangerous. Early weapons using early gunpowder were not always safe.

The first transition was easy: Going from wooden to metal barrels. Not only did this change the early “bombards” from unwieldy, stationary artillery pieces to marginally mobile ones, metal tubes led to hand-held individual firearms. Well, marginally hand-held, using a monopod with a fork at the top to hold the musket in place. But the race was on.

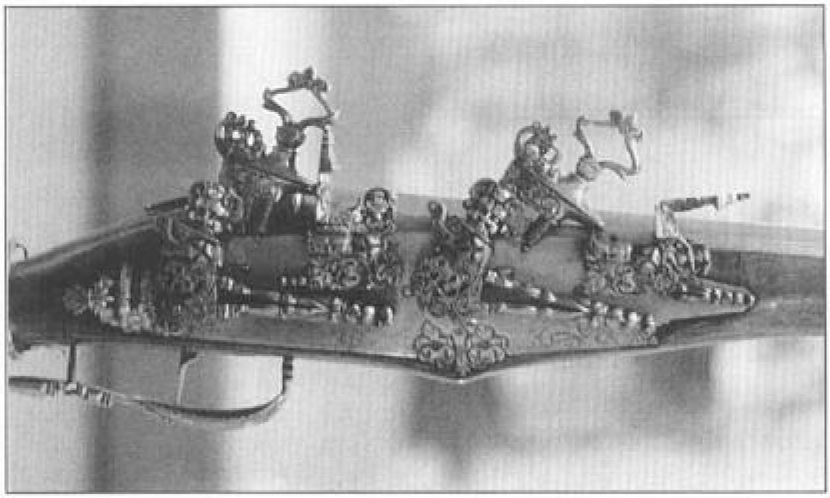
The powder changes were quick in coming. Early powder was a mixture of the three components, and would settle out during shipping. The gunners would have to re-mix the powder when they got to the battle. “Corned” powder was powder that had been wetted, mixed, dried and re-ground. As you can imagine, grinding black powder into the right consistency is a hazardous profession, but the result was a product that didn't change with storage or shipping, and was much safer and uniform to use.



In the production of gunpowder, quality matters. This is a test gun. A measured charge will propel the spring-marker a known distance if the powder is correctly made.

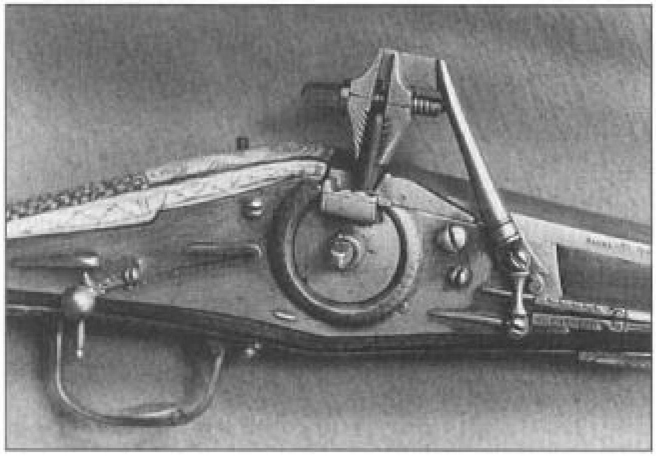
As late as the Crimean War (1851, The Black Sea, Britain vs. Russia, and the famous poem “Charge of the Light Brigade”) armies still used smoothbore muskets as the general-issue weapon. It was not until a French ordnance officer by the name of Minié developed a hollow-base bullet that expanded on firing that development diverged. Before that brainstorm, the development of firearms was the development of smoothbores, i.e. shotguns. The British Empire was secured, held and lasted long enough to start crumbling during the time of a single model firearm. The “Brown Bess” was a smoothbore flintlock musket whose design was finalized in 1710. The heart of the Brown Bess was the perfected flintlock, a significant advance over competitive systems. The earliest individual smoothbores used the matchlock system. Developed in 1460 in Germany, the matchlock was simple: a pivoted serpentine lever held a clamp at the chamber end. The shooter carried a length of cord that had been soaked in a flammable mixture and then dried. Once ignited, it burned slowly. To fire the loaded smoothbore the shooter would insert one end of the cord (both ends were kept burning, just in case) in the clamp, puffed on it to get it hot, opened the touch-hole cover, and then pointed the “firelock” at the enemy and squeezed the back end of the serpentine. After the matchlock, came the wheellock, snaphaunce and miquelet. The wheellock is the same kind of mechanism as a cigarette lighter. Expensive, fragile and needing a lever to wind it just prior to shooting, the wheellock was not an ideal military weapon. The

snaphaunce and miquelet were clumsy precursors to the flintlock, requiring extra parts and fitting.



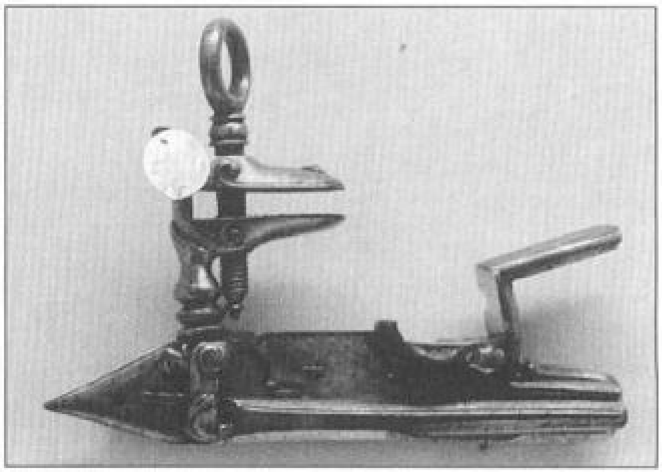
***Early firearms were the weapons and toys of the wealthy. Not only is this snaphaunce elaborately decorated, it is a double-shot single barrel. It was expensive and high-tech for its time*.**

Despite all the effort that went into developing firearms, the archer was a dominant force on some time. The greatly outnumbered British under Henry V defeated the French at Agincourt in 1415 with accurate longbow shooting. The French knights couldn't advance uphill through the mud faster than the British archers could shoot them down. (One can hardly avoid comparisons 500 years later.) The archer was considered so valuable to national defense that a hundred years later Henry VIII attempted to ban bowling and other sports because they “diverted English men from archery practice.” In rapid fire a skilled archer could launch 10 arrows a minute and place every one of them into a man-sized group more than 100 yards away. At close range an English cloth-yard shaft would go through all but the most heavy and expensive armor. At the same time a matchlock might be fired twice a minute, and guarantee hits only inside 40 yards.



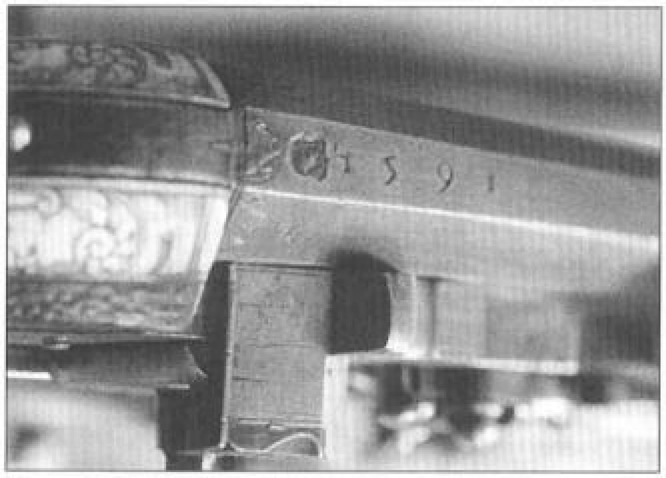
***The wheel-lock operates like a spring-driven cigarette lighter. This one is elaborate, expensive, and again, highly decorated*.**

The Brown Bess could be loaded prior to a battle, and depended upon to fire when needed. It could be quickly (compared to the other style locks) reloaded, and was durable enough to stand up to hard service. With changes in length, and converted to percussion, the same musket was still in use during the Crimean War. Now, 140 years is a long time for any design to hold on, especially a military one. The record may never be broken. After all, do you seriously expect the U.S. armed services to still be issuing M-16s in the year 2105? Even highly-modified ones? (However, I fully expect 1911 pistols to still be in common use, assuming we can still own them, in the year 2051.) Despite the advances in equipment by 1776, Benjamin Franklin still suggested arming revolutionaries with longbows. The drawback was training time. It takes years to train an archer to effectiveness. Granted, a musket was less effective, but the training period was a few weeks.



Until machine production in the 19th century, all firearms parts were made by hand. This early flintlock was made with hand forges and files.

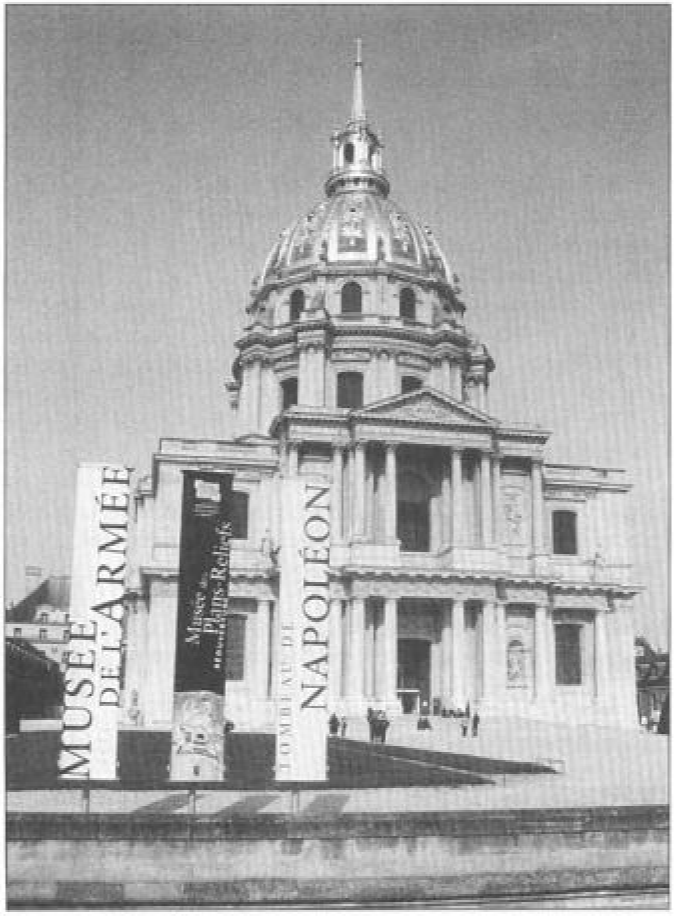
When the musket was used as a military arm, the design had to conform to military needs. The musket was first a "firelock" but primarily a bayonet platform. After the volley, the troops would close the gap with the enemy and fight with bayonets. What they really needed at that point as an instructor was a senior NCO from the Roman Legions, because once the volley was gone, warfare tumbled back 2,000 years. During the Revolutionary War, colonial militias could inflict casualties on the British regulars with accurate rifle and musket fire, but could not keep those regulars from going anywhere they wanted. Even when they loaded their muskets with "buck and ball" (buckshot and a large lead ball) they couldn't keep the British from advancing by gunfire alone.



This wheel-lock is more than 400 years old, and could be loaded and shot today. Quality costs, but it also lasts.

The colonists found their Roman NCO in General Von Steuben, who drilled the tiny army in the tactics and discipline of the day. The next spring, when the newly-trained revolutionary army marched out to meet the British, the commanding officer of the British was heard to remark “Those are regulars, by God.”

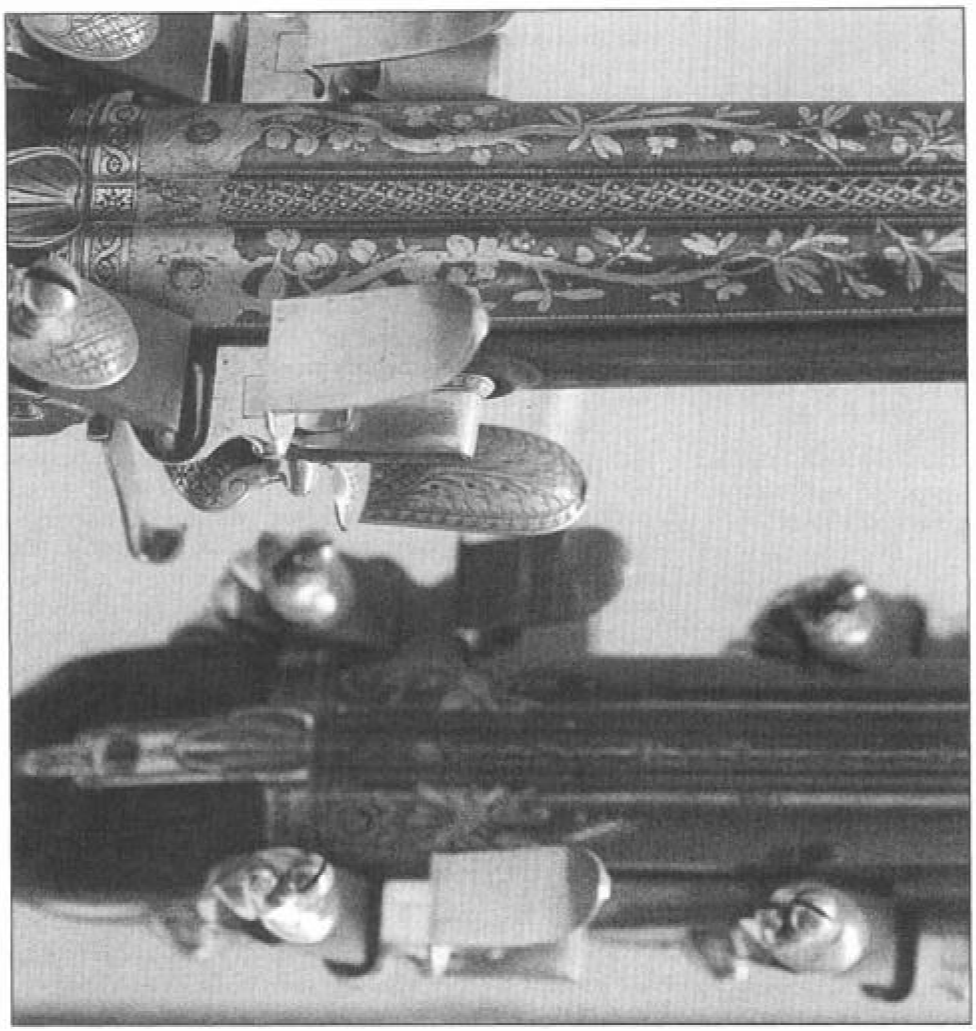
The rifled musket changed that. With the speed of fire of the musket, and the accuracy of a rifle, units could no longer maneuver in the open, and close the distance for a bayonet charge with impunity. Unfortunately, it took several more wars for the knowledge to become common. Companies and battalions that tried to do so in the Civil War found themselves taking horrendous casualties before they could close the distance. Military needs and desires went to the rifle, and left the shotgun for a while. Freed from the need to be a bayonet lever, shotguns began to get lighter, more responsive and better suited to hunting. The ethos of taking game only on the move, birds in flight and small game while running, took hold. The British in the next half-century turned the shotgun into an extension of the shooters arm. Well, the extension of a shooter who could afford to have a shotgun tailored to him as if it were merely one more accessory to his clothing.



The French Military Museum houses a fine collection of black-powder martial weapons and the Tomb of Napoleon. The tomb is even gaudier than some of the weapons on display.

The British shotgun grew out of the double-barreled muzzle-loader. When shotguns were still muzzle-loaders, the easiest way to have a second shot readily available was to have a second, loaded shotgun. To build two barrels on one gun took skill, or the result was so heavy as to be unusable. British hunting was (and is) primarily driven-game hunting. The Gentlemen hunters wait by their shooting stands as the game is driven towards them, and then shoot it as it attempts to flee past. The shooting is fast, and the game is almost always going straight overhead, or past on the sides. With each development in firearms technology, the British gun-makers made the "double" lighter, handier, more responsive, more reliable and more decorated. They finally created a 12-gauge shotgun that weighs less than 6 pounds, is utterly reliable, hits where you look (provided it has been fitted

to you) and costs more than a car. If you can afford the tens of thousands of dollars such a shotgun costs, then you have your choice of engraving style, amount of coverage, wood selection and chokes. You can have an extra set of barrels fitted, starting at several thousand dollars and going up. But you have to be patient, as the gunsmiths who build such wonders are booked solid for years in advance.



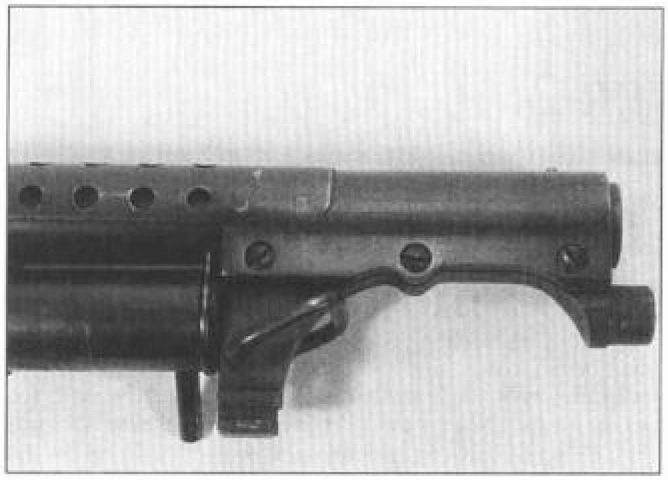
These spectacular shotguns are notable not only for the gold inlay in the barrel and ribs, but the number of shots. Each is a four-barreled gun, with two locks top and bottom.

The American path was and still is different. Right in the middle of the cartridge conversion process for shotguns, in the 1890s, John Browning kept insisting on a different idea: The repeating shotgun. At first Winchester

insisted on a lever-action shotgun. I'm sure John wasn't too keen on the idea, but they were offering him money for a lever shotgun, so he did his best. Awkward, fragile, clumsy to use and borderline homely, the Winchester lever shotguns didn't catch on. It didn't help that Browning designed the Model 1893, and then updated it with the 1897. The '97 is a pump. Without the need for the linkages and elbow room a lever needs, the receiver of the '97 was sleek and compact. No shotgun is truly durable. The wall thicknesses of the barrel and magazine are not enough to stand up to abuse, but the '97 was much more durable than was a doublegun. For someone depending on a shotgun to feed his family, the '97 was much more attractive than any double. For a Sheriff on the Western frontier, dealing with dangerous men was a thankless task. When faced with more than one, a double might not be enough extra insurance. Faced with a resolute sheriff holding a Winchester pump and its seven rounds of buckshot, even the most hardened desperado might think twice.

Once American hunters took to the pump, every manufacturer had to make at least one, and within a couple of decades doubles were on the wane. One place doubles hung on for a long time was at the gun club. Early competitions (mid to late 19th century) were live-bird contests. Each bird was released from a trap in the middle of a circle. Each contestant had to shoot the bird and drop it within the circle. Even if killed, if the bird fell outside of the circle the competitor was said to have “lost” it. (What can I say, times were different then.) The competitor was only allowed two shots at each bird, so doubles worked just fine. And, no gentleman would be caught on the club grounds with a repeater. It was the hunting gun of the working classes! (Of course, the fact that early live-pigeon shoots were deemed to be diversions for the lower classes, and occasions for vigorous gambling, were quickly overlooked when gentlemen decided to take up the sport.) The difficulty of obtaining birds and the irregularity with which they flew led competitors to other targets. An early target was glass balls. The throwing mechanism was a spring arm that threw the balls straight up. A later and less expensive target is the “clay pigon” that we all know. Its disk shape required a different throwing mechanism, and threw the bird out rather than up. By angling the throwing arm, the bird could be thrown up and away from the shooter. The game of trap shooting had been invented. Later, skeet was invented as a target game that more closely simulated the various angles with which hunters were faced. After all, if you spent the

whole summer practicing on trap with its upwards and going-away targets, how does that help you when in the fall a flight of ducks is attempting to land on the pond in front of you, coming straight at you and going down?



Some military requirements haven't changed since the time of Caesar. When the United States went to fight in France in World War I, the shotguns had to have a bayonet adapter.

If the pressure for quality and reliable guns wasn't enough, the interest in the sporting applications of shotguns put more pressure on gunmakers. In short order, the best makers were turning out beautifully balanced shotguns of unparalleled reliability. And for those who could afford them, great beauty.

Just when it seemed that the shotgun would disappear from the military equipment lists, America entered The War to End All Wars. General Pershing quickly determined that shotguns would be of great use in the trenches of World War I, and the U.S. Army has had shotguns of various types in service ever since.

By the end of the 20th century, some would say that shotguns had gotten back to being bayonet levers. Faced with the requirement to use steel shot, longer shooting distances, and harder-to-get-to hunting locations, hunters have upgraded. Back when Eisenhower was President, a duck hunter might have a double or a pump that weighed 8 pounds. It would be loaded with an ounce and a quarter of No. 4 lead shot, and choked improved cylinder or modified. The shells probably weren't magnums, and he would be well-armed for the task.

Now, a hunter who doesn't go out with a shotgun chambered for a 3-½-inch 12-gauge shell, or even a 10-gauge, that weighs almost 10 pounds (to deal with the recoil on those magnums, oh, brother) throwing a payload of 1-½ ounces of BB's, feels undergunned. And he will be camouflaged to the gills, with a pocket full of screw-in choke tubes to deal with any potential problem. The modern duck and goose gun can be as long and heavy as the old Brown Bess musket. But without the bayonet. Even the newest duck hunter doesn't think he will have to repel web-footed boarders.

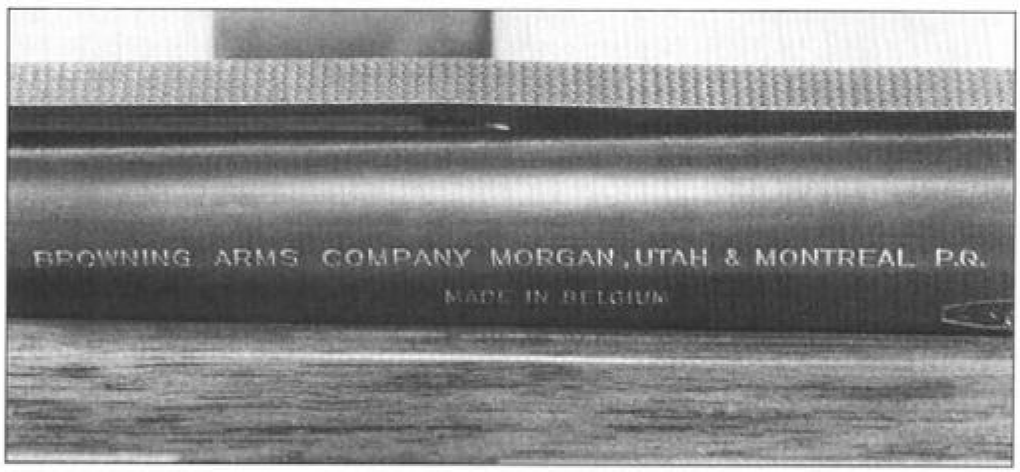
For night raids and trench clearing, there wasn't much better in 1917 than a Winchester pump. This shotgun must have been great comfort to a Doughboy in No Man's Land.

Chapter 2
Black Powder to Breechloaders And the Transition to Smokeless

The origins of black powder are somewhat hazy. We know the Chinese had black powder or similar compounds, but used them only for fireworks, firecrackers and noise-makers. Using the force of the powder to propel a projectile just didn't occur to the Imperial Chinese military establishment. Either that, or having the many thousands of trained warriors and potentially millions of peasant conscripts already on hand, who needs noisemakers to scare the enemy? It took the dedication to war of the Europeans to develop this new technology.

Faced by a charge from these fellows, what infantry commander wouldn't want more firepower? Repeating firearms irrevocably altered the balance between mounted and foot soldiers.

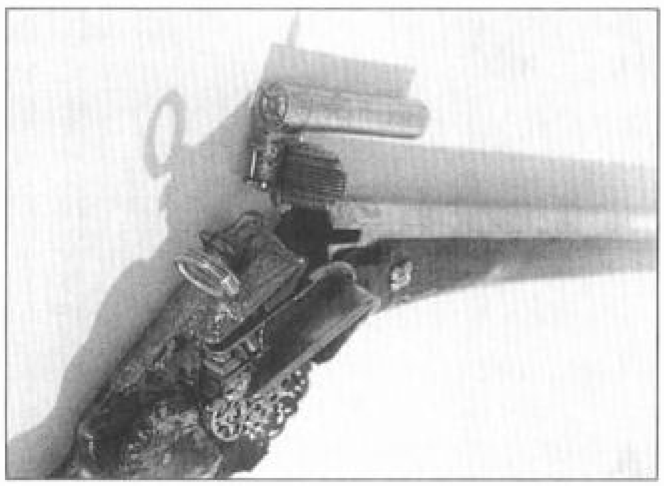
In the centuries from the first use of black powder to the middle of the 19th century, experimenters had tried to come up with some sort of repeating mechanism. After all, in the military context, if some is good, more is better. If you could rain bullets down on your enemy, they couldn't cross the battlefield to meet you. (It can be positively depressing how many technical advances came from the need to gain an advantage in battle.) The problem wasn't the black powder, but the manufacturing methods. Getting a portable cartridge, and even a mechanism to feed it wasn't the problem. The problem was keeping the combustion process sealed away from the shooter. Doing so took two things, each precisely manufactured. First was the barrel, and second the repeating mechanism.



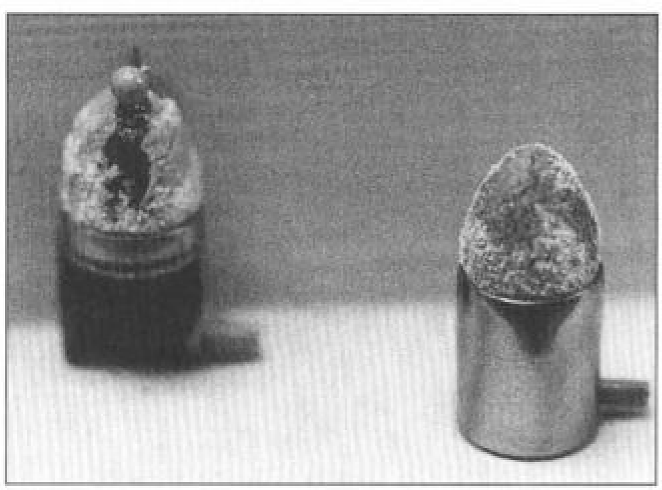
For a century now, barrels have been made from solid bars, bored and reamed, like this Browning barrel.

Many barrels, high-quality ones, were made by the Damascus method. Hand-forging a section of steel around a mandrel in a spiral pattern produced a good (for the time) barrel, but not one that could be mass-produced or produced to exacting, repeatable tolerances. The later method, employed by larger makers, of forging a barrel from a flat section of steel, punching it into a “U” shaped channel and then forging the seam produced more uniform barrels, but they were not much stronger. Without uniform barrels, you could not depend on the cartridges to seal the chamber on firing. Some early breechloaders, such as the Ferguson rifle, had a good seal. Developed just before the Revolutionary War, it used a spiral screw at

the rear of the barrel. Turning the trigger guard rotated the screw down to expose the breech. It was accurate, reliable, sealed the breech well and too advanced for the British military. A later American attempt was the Hall. The Hall used a hinged and removable lock and breech assembly. By dropping each pre-loaded block into the rifle, a trooper could fire until his supply of pre-loaded breeches was used up. In a pinch, the removable block could even be used as a pistol of sorts. The problems with the Hall were fragility, poor gas seal, and the heavy weight of a supply of blocks.



Even from the earliest times, gunsmiths and inventors worked on breech-loading firearms. This is a breech-loading flintlock that uses iron or steel cartridges each with an integral frizzen.



***The pinfire cartridge was an early attempt to perfect the enclosed cartridge. Each round has its own firing pin, which sticks up through a slot cut in the edge of the breech. The hammer strikes the pin, firing the cartridge*.**

Precision manufacturing allowed the use of cartridges made of brass instead of steel. Precision manufacturing also made the brass cartridges a tight seal against the combustion of the powder, increasing safety to the shooter. The impetus for the precision manufacturing was the American Civil War. The need for weapons, and ammunition to feed them, was greater than hand-production could supply. Machine-made firearms had the advantage of dimensional stability. That is, in order for all ammunition to work in all rifles of a given caliber, both the bullets and the bores had to be made to precise, and limited, dimensions. When a gunsmith was making his muzzle-loading shotguns one at a time a “12-Gauge” could mean his barrels were 12-gauge plus or minus .050” and no one would know. When reliable cartridges were designed and manufactured, a shotgun could not have a chamber smaller than the largest cartridge. If the chamber were too much larger than the cartridge, there would not be a proper gas seal. The advantage that troops using cartridge-firing firearms had over their muzzle-loading opponents was significant. A rifled musket could be loaded and fired four times a minute by a skilled soldier. He also had to stand up to reload. A soldier using a cartridge-firing rifle could fire at least twice as fast, and could do so, including reloading while prone. The Federal Army had to have cartridge firearms, and was willing to spend money to make the arsenals that could produce them. If cartridge repeaters had so much going for them, why was so much of the Civil War fought with muzzle-loading rifled muskets? Production, or rather, the lack of it. It does little good to equip an army with breech-loading rifles if you cannot provide them with ammunition. With arsenals set up to produce muskets and ammunition, the Federal Army would have been negligent not to use them. Because proven breech-loading weapons were available with ammunition to feed them, they were used. Some units even bought new designs out of their own pockets in order to gain an advantage.

Balancing the need for production against tactical advantage is not new. In 1543 English armories developed a method of making cannon barrels from cast iron instead of bronze. Cast iron is heavier, weaker and more

brittle than bronze. And it rusts. When the tubes burst they shattered, creating casualties of the gun crew and adjacent soldiers. However, a cast-iron barrel can be made for a fraction of the cost of a bronze tube. Faced with the option of going to war with one company of artillery or four, for the same cost, what would you do?

After the Civil War the advantages of self-contained cartridges were so great that Colt did a brisk business converting cap-and-ball revolvers to fire cartridges. The same advantages applied to shotguns, and gunsmiths were quick to design breech-loading shotguns.

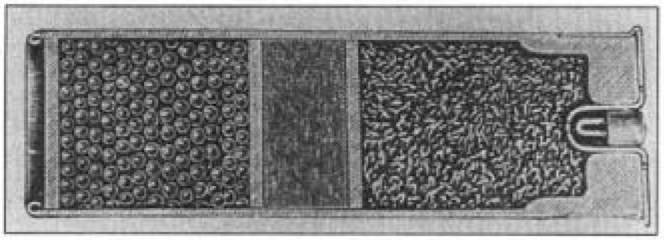
One design requirement of black powder flintlocks and percussion firearms was the need to keep the shooters face away from the breech. Unlike today, a shooter in the era before cartridge shotguns kept his head up, and away from the breech. To get the barrels up to his line of sight, the stock had to have an appreciable angle down, called drop. The drop in the stock created a lever to direct the force of recoil into the shooters face. Ever since cartridges have become common, stocks have gotten straighter.

Getting to today's plastic shotshells took quite a bit of work. Early shotgunners had a choice that many shooters today would think odd: The pin fire. In the early days of shotshell design, primers were not an easy thing to manage. Making the mixture (even coming up with an appropriate compound) was not easy. Getting enough into a shell to create complete combustion of black powder took more space than modern primers have. To maximize the use of the priming mixture, each shell had its own firing pin, resting directly on or in the priming pellet. The Lefaucheux system had many merits, primarily that it worked. Since shotgun makers were applying for design patents for breech-loading shotguns in the 1850s, the pinfire system came into common use and hung on for a long time. Remember, the shift to any new technology takes time, and in the pre-computer age it sometimes took a generation or two. As precise as manufacturing had become by the 1880s, primers were still expensive. If the priming compound was not evenly distributed in the cup, misfires and hangfires could result. I think pinfires also had a following (and for quite some time in Europe) for gunsmithing ease and shooter comfort.

And even after the pinfire was gone, the hammers would stay. Imagine yourself a gunsmith used to making a shotgun with external hammers (as black powder percussion and pinfire shotguns still would have been for decades by 1880). Or a shooter used to the visual safety margin cocked or

half-cocked hammers represented. A shotgun that broke open in the middle and used self-contained cartridges was a shock for many older shooters in the 1880s. The hammers kept things familiar enough for both father and son to keep shooting even when the pinfire cartridge disappeared. Webly & Scott, shotgun and rifle makers in Birmingham, England, still listed double shotguns with external hammers in their 1914 catalog. I'm sure sales of hammer guns did not come back after the Great War. Anyone interested in shooting would not want to put up with such old-fashioned nonsense.

Military depots and gunmakers would test each batch of powder they received. If the powder did not register the proper power when fired in a test-gun like this, it would be rejected.



***The shotgun shell was developed to hold a large amount of black powder. When smokeless arrived, the wad had to be changed to take the extra space left by the new more-compact powder. When steel shot arrived, there was plenty of room to adjust again*.**

Americans did not take to the pinfire in anything like the numbers that the Europeans did. I think it was the emphasis on breechloaders and ammunition capacity that crimped the pinfire's style. As much of a genius as John Browning was, I think even he would have thrown up his hands if Winchester had insisted on pinfire shells for a repeating shotgun. And if the ammunition companies were going to make centerfire shotgun shells for repeaters, then the makers of American doubles would just have to adapt to them. On both sides of the Atlantic, the pinfire was on the skids even before the next revolution, smokeless powder, came along.

Successfully developed by the French for their military rifles, smokeless powder was a wonder. It was compact, powerful, and produced hardly any smoke. It revolutionized military rifles and cartridges. In less than a generation, every major power and most of the minor ones had switched to a smokeless, magazine-fed, repeating rifle as standard issue. In the same time, many shotguns were blown up, and countless owners injured, maimed or killed. You see, black powder had some nasty habits, in that it was a low-grade explosive and could detonate in open air. A flame, spark or shock could set it off. But, used in a firearm or cartridge it had the comforting condition of being bulky for its power. You could hardly stuff enough black powder into a cartridge to make it hazardous to shoot. Black powder could be measured by volume, and the bullet or shot charge used to compress the powder on seating.

Smokeless powder is not an explosive but a flammable solid. In open air it burns fiercely but will not detonate. It is much more dense than black powder, and much more powerful. If you took the volume suitable for black powder in a cartridge and filled it smokeless, you would have created a

bomb. Shooters and reloaders who were used to black powder had a difficult time creating enough fillers to take up the space difference. Powder manufacturers even developed special semi-smokeless and smokeless powders that were high-bulk and could fill the powder space in shotshells.

Even this was not enough for some shotguns. For centuries barrels had been made by the Damascus method. Two pieces of metal, one each of iron and steel, would be heated and hammered flat. The iron could be a common grade of scrap iron such as reclaimed horseshoe nails. (Could I make this up?) In an age of horse-drawn everything but railway carriages, leftover bits of horseshoe nails were common. The steel could be a good Swedish or German steel, or any tough and hard steel. The two flattened and clean pieces would be laid together, and the real hammering would begin. Heated and folded, heated and folded, the steel and iron would be layered many times, like a pie crust. Eventually the layered metals ended up as a rectangular bar. The bar was then heated and twisted in a spiral (with a lot more hammering) around a steel rod called a mandrel. As it was twisted the edges would be “welded” together. I use quotes because that was the term used at the time. The edges were actually forged together. The mandrel was then slid out of the finished tube. Once cool, the tube was filed, polished, reamed and turned into a barrel. For its time, and when used with black powder, a Damascus barrel was quite strong. For those who like the looks, it was also beautiful. The swirling, repeating pattern of the iron and steel would take blueing differently, and the pattern was obvious to any who saw it.

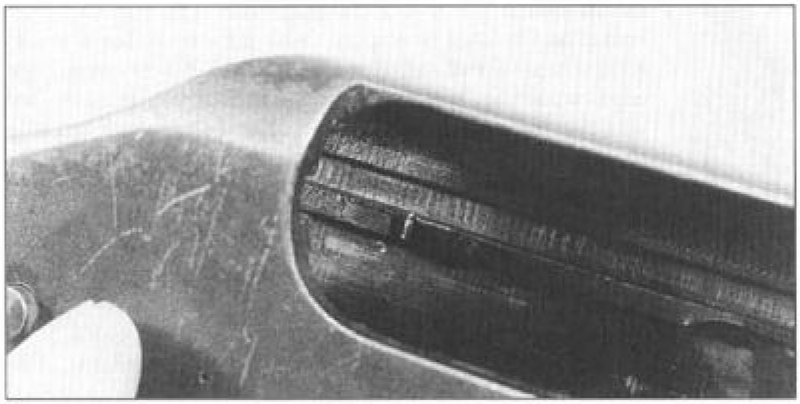
The pattern is also the weak point of Damascus. The edge between the iron and steel is a joint. Rust has a way of attacking joints. The joint is also weaker than the iron or steel even if it isn't rusted. The burning rate of smokeless powder created two problems for Damascus barrels. The peak pressure of smokeless is greater than that of black powder, and the rate of onset (the steepness of the upwards curve to the peak) is much faster. Smokeless hits harder and comes on faster than black powder, enough so that damascus barrels can rupture. Even if the pressure peak is kept down to that of black powder, the rate of onset is too quick and can still rupture a damascus barrel. The lesson learned then, and one that holds true today, is do not fire smokeless shells in a Damascus barrel.

To speed up the process, manufacturers looking towards mass production instead took a long flat section of mild steel (it was all mild steel in the 19th

century) heated and fed it into a forge. The forge would stamp the steel into a “U” which was then finish-forged over a mandrel and the single seam “welded” shut. Much faster and cheaper to make than Damascus, it also produced a barrel more amenable to lathe-turning to final shape. Not until deep-drilling of steel rods became common did shotgun barrels lose their seams. In deep-drilling, a steel rod is drilled its length, and then reamed and polished to produce a barrel blank. Compared to the earlier forged barrels, a drilled barrel is absolutely uniform as a produced item. That uniformity greatly aided the development of reliable and safe breech-loading mechanisms. The new steel barrels were often referred to as “fluid steel” barrels. Not because the steel was more flexible, but because it came out of the crucible liquid, and was poured into molds to make ingots that were forged into bars, rods, rails and I-beams.

Damascus had been the mark of a fine gun for so long that some makers would take their new and stronger fluid steel barrels, and etch a Damascus pattern onto the outside. And you thought appearance for appearances sake was a late-20th century innovation.

While the strength drawbacks of Damascus eventually led to its demise as a barrel steel, the American emphasis on mass-production would have put the skids under it even without the advent of smokeless powder. (Damascus does seem to be making a comeback as a knife blade material.) As if the weakness wasn't enough, producing a Damascus barrel was more expensive. The many thousands of hammer blows it took could only come from a skilled worker, and his output was limited to a few barrels a day. Once created, the Damascus barrel had to be hand-filed, bored, reamed and polished. The iron and steel were each of a different hardness. Trying to turn a Damascus barrel on a lathe as a production process would have been a nightmare. With orders for thousands of shotguns, Winchester, Remington, Savage and the other large manufacturers could not even consider making barrels from Damascus.



Modern designs sometimes mean non-traditional approaches. Unlike the elaborate ejectors found on some doubles, this pump has an ejector that is just a sheet-metal tab in the path of the empty hull.

Damascus held on for a while in doubles, where mass-production was slower in arriving. One of the tricks of producing a double was in “regulating” the barrels. If you fasten the barrels together and to the shotgun parallel to each other, the center of the patterns of each barrel may not agree with each other. Trying to hit a fast-moving duck or goose is hard enough without having to remember “the left barrel is high and the right barrel is left” or some other mantra. Regulating the barrels in a double involves test-firing the shotgun before it is finished (termed “in the white” because it hasn't been blued yet) and adjusting the fit of the barrels to each other. The muzzle ends of the barrels are bent, tweaked and wedged until the center of each barrel hits to the same point at 40 yards. With all the hand work involved, the extra work of Damascus barrels is a small additional cost.

In the United States, test-firing shotguns (and rifles and handguns, too) is performed by the factory that made them. Considering the loss of business in the old days, and the potential litigation today, each factory is greatly interested in making sure each shotgun is properly designed and manufactured before it leaves. Things were (and are, for as long as they continue to have firearms) different in Britain. Centuries ago the established gunmakers found themselves competing against imports and cheap, shoddily-made local junk. To protect their customers (and to keep out the junk) they established “Proof Houses.” The London Proof House received its charter in March of 1637! The Birmingham Proof House received its charter in 1813. The job of the inspectors at a Proof House was to pass

judgment on the safety of each gun presented. Once it had been measured and gauged, it would have a “proof load” fired in it. The proof load was a standard-size shell loaded to greater pressure than regular ammunition. After digesting the proof load, the shotgun was again measured and gauged. If no critical dimension had changed, it was deemed to have “passed proof” and was stamped as such. Even imported firearms had to go through the Proof House in order to be sold.

The British have never been into the high-pressure magnum ammunition that Americans seem to be enamored with. With sufficiently thick chamber walls and a low-pressure operating limit, British shotguns would last forever if properly treated. There was so much safety margin that many British Damascus-barreled shotguns were re-proofed with smokeless powder. Again, do not fire smokeless shells in a Damascus-barreled shotgun, even if you find British nitro proof marks on it. The operating pressures it was proofed to are probably lower than the standard pressures current American shotshells are loaded to.

The purpose of a proof house is to prevent poor-quality goods from being sold. And to protect a country's internal production capacity from imports. The “W” or “double V” is proof this piece passed inspection and test.

In the space of a generation, shotgun hunters went through a gantlet of choices. From muzzle-loading, percussion shotguns with outside hammers to doubles with internal hammers, automatic ejectors and shells we would recognize today. Or, for the real technology buffs, pumps and semiautomatic shotguns. And all the newest technology used smokeless

powder. Reloaders had to try to keep up, switching from black, to semi- to high-bulk to smokeless powders.

Proper testing meant using a known ammunition. This Boulange chronograph that Fabrique National used to use is now on display. It took a crew of technicians to use this, test the firearm, and record and calculate the results. It's much easier today. Hooray for electronics!

One legacy of the change from black to smokeless is so puzzling and arcane that many shooters don't even try to follow it: the “Dram equivalent.” Many shooters simply go by brass height. “I need low brass” or “Pheasants take high-brass shells” and go with what they learned as kids. The convenient measure of black powder for shotgun was the dram. Certain combinations of powder and shot were found over time to most efficient, and the ammo makers settled on them. The “Three dram” load was 3 drams

of black powder (obviously) and l-⅛-ounce of shot. If you think the choices today were vast, you should look into the catalogs of a century ago. It was common for hunters then to have the ammunition factory custom-load their ammo. If you ordered the minimum number (500, 1,000, 1,500 shells) you could have any safe combination of powder and pellets size and weight. If you thought that 3-½ drams of powder and 1-¼ of No. 4 shot was death on ducks (it was and still is) you could have the plant custom-make you enough to get you through the season.

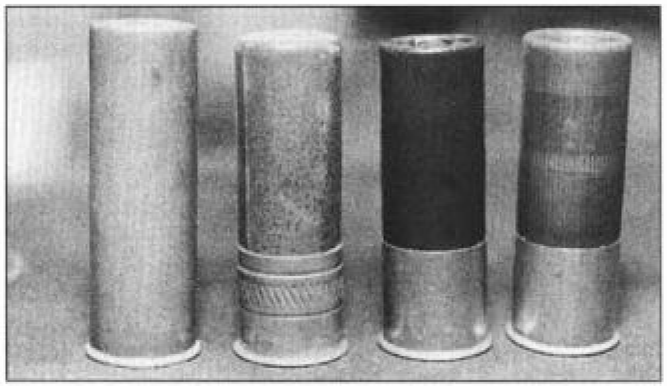
When smokeless powder showed up, you couldn't just shovel three drams of it into a case or you would blow up any gun it was fired in. So the ammunition plants came up with the transitional “Dram equivalent.” By explaining the power of their shells in the language familiar to their customers, the ammunition makers planned to move completely out of the black powder business. What measuring scale was supposed to replace it? I'm not sure anyone knows, because the “transitional” measuring system is still with us over a century later.

And what a century it has been. Some things haven't changed much at all. Hunters still don't lead racing ducks and geese enough, and agonize over shot size and pattern density. Other things have changed radically. A pair of duck hunters camouflaged to their eyebrows, launching a duck boat from the trailer at the back of their SUV would be akin to men from Mars if seen by a duck hunter a century ago. And the radio-controlled paddling decoys? Wondrous stuff.

One good thing about the transition to smokeless powder was that it left us with a high-capacity hull and compact propellants. By using the extra space for cushioning, the shot-shells of today give their pellets a smoother ride than shotshells did back then. With the excess space that used to go to black powder freed up, the wad could be re-designed to protect the pellets. It also made possible larger payloads, which used to be devoted to extra pellets. Before the switch to steel shot, shotgun shells could be had with nearly 2 ounces of shot in them. Now, with the bulkier steel, payload weight is back down to what it was a generation or two ago. Again, the capacious hull gave designers, hunters and reloaders the room to work with.

When the Army adopted shotguns for use in the trenches, they adopted a new finish, Parkerizing, and full-length brass shells. Both the guns and the shells are now prized collectibles.

Oh, and the low and high brass? Another holdover, from the days of paper shotshells. Shells used to be assembled from paper tubes, base wads and crimped-on brass rims. The higher brass was for one of two reasons. The optimists held it was to keep the hull together under the higher pressure of a hotter hunting load. The pessimists felt it was simply a sales gimmick to get people to pay a lot more money for shells that only had a little more shot and powder in them. Today shells are made of plastic, and are molded or formed from a single piece. The brass (actually brass-plated steel) is there solely for the extractor to hold on to. Each type of hull made by a manufacturer has the same strength, regardless of how high the brass is. Some don't even bother with a brass rim, and have a plastic hull with a steel washer inside as support. If you are reloading, use what works and what the reloading manual suggests. If you are reloading but aren't using a reloading manual, get one and read it.



In the time before plastic the only way to ensure a water-tight cartridge was to make it from brass. The all-brass cartridge (left) is very expensive. For most uses, paper (2nd from left) worked just fine. Then came plastic. The high base is a factory indication of high velocity or heavy payload.

Chapter 3

Tools, A Place, and Practice

"Give me a place to stand and a lever long enough, and I can move the world" ***Archimedes***

Give me a comfortable bench and enough light and I can take apart any shotgun and fix it. If you are going to work on your shotguns with any comfort you are going to need a place to work. Something a little larger and more sturdy than your lap is required. I have disassembled, cleaned, repaired and inspected shotguns with no more than a shop apron spread over my lap, but it wasn't by choice. You bachelors out there, do not get too attached to using the kitchen table. As soon as you find someone willing to put up with you, the kitchen table will become forbidden territory for gun work. Besides, do you really want the lubricants, solvents and powder residue working its way into your food?

Your workspace must be well-lit. The overhead fluorescent light gives good tight, and the white watt next to the bench adds an even reflection. The dehumidifier next to the bench is a good idea in some climates. Arizona residents need not bother.

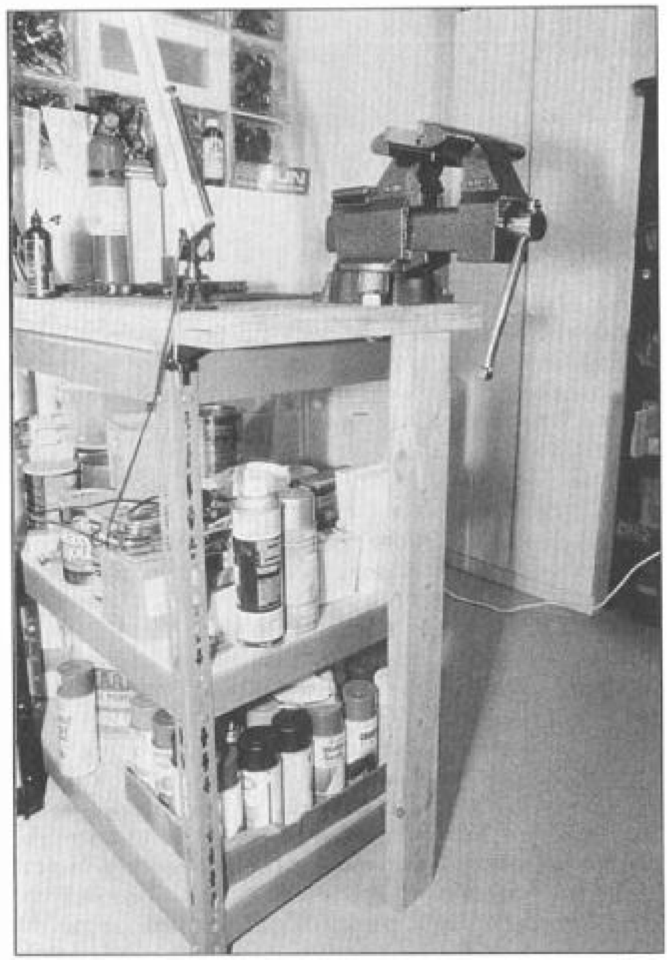
First, there should be light. You can't work in the dark, and you can't work very well in the typical gloom of a basement, garage or spare room with only a centered ceiling light. A fluorescent fixture over your bench will fill the area with even light, without being too bright or hot. You'll need additional light, in the form of a flexible desk lamp. The desk lamp can be positioned and angled to shine directly into an area as you're working. Rather than fish around inside a receiver by Braille, you can shine the desk lamp into it and see what's going on.

You need a sturdy bench. The bench can be in a spare room or large closet, in the basement or the garage. It should be solid wood, not particle board. You can build a bench from lumber or heavy-duty steel shelving. One of my workbenches is made from lumber. It came as a ready-to-assemble kit from one of the “big box” stores. I also used shelving rated for 1,500 pounds per shelf, and stiffened the tops of both benches by laminating plywood to them. The particle board shelving that came with the steel frame is sturdy enough to hold things, but not sturdy enough support a vise. You should have a vise. A solid vise holds parts securely while you are filing on them, measuring them or using a tap or wrench on them. A good vise is a more solid arrangement for holding parts than the strongest person you know, and you don't have to worry about missing the part and hitting your buddies hands if the part is in a vise.

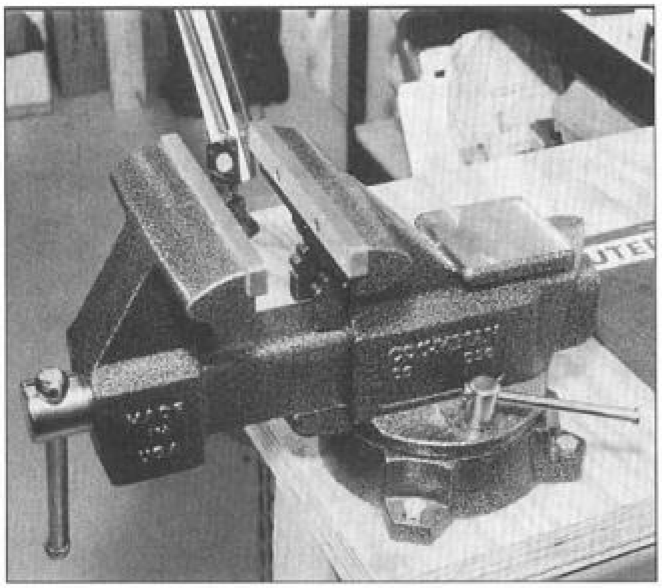
In addition to the overhead light, a flexible desk lamp adds light just where you need it. Notice the fire extinguisher on the end of the bench. Keep it close at hand when soldering.

Bench height and vise height are important. The bench should be high enough that its working surface is a couple of inches above your wrist when you stand next to it. If you have to bend over to grab something off of it, it is too low. Vises are designed to stand on top of a bench of the proper height. Depending on your height, you may have to vary the height of the bench when you assemble it. At the proper height, you do not have to bend over even the slightest to pick something up off the bench, or to file something in the vise. The easiest way to find the correct height for YOUR

bench is to work on a bunch of different ones and see if they cause you pain. A low bench will cause a stiff back, while a high bench will tire your arms and cramp your shoulders.

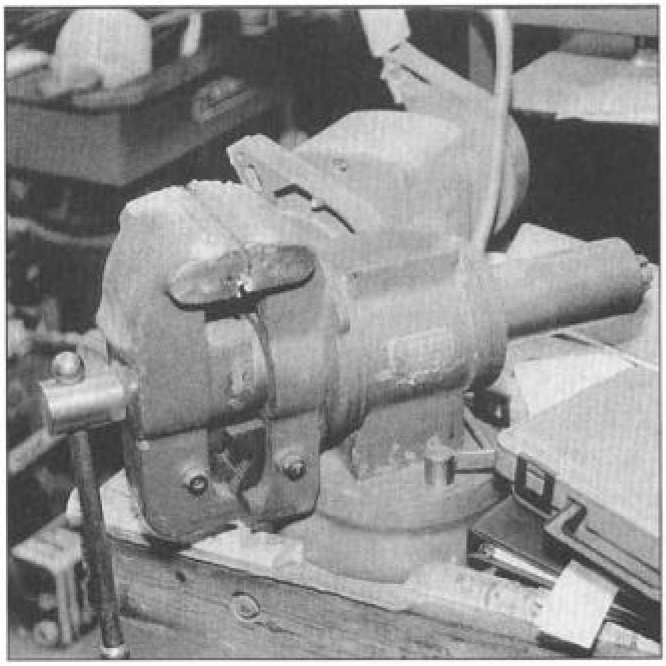


You want a solid, sturdy bench. This one has been stiffened by laminating plywood to its top surface. The vise on its overhang has been given additional support with a post. The bench is kept in place by storing ammo on its lower shelf.



A solid vise is a must. This medium-duty one is up to all tasks short of unscrewing a rifle barrel. As the bench isn't up to that either, the barrel vise has its own steel post elsewhere.

If you are going to do some work on your gun at the range, a small vise you can clamp to the bench is very useful.



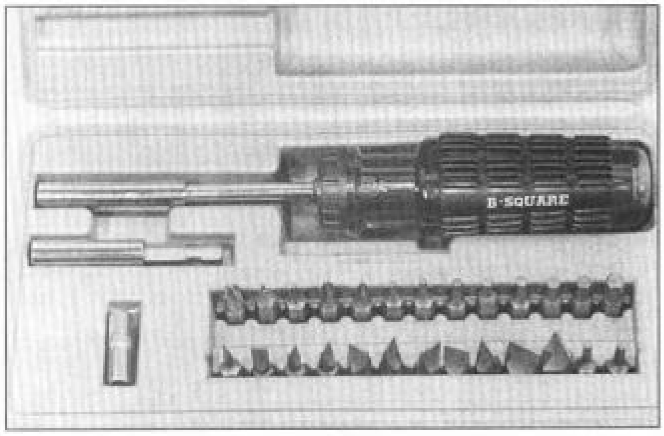
This heavy-duty vise is everything you'd need.

A cleaning cradle lets you work on your shotgun without having to clamp it in a vise, or hold it in your hands or lap.

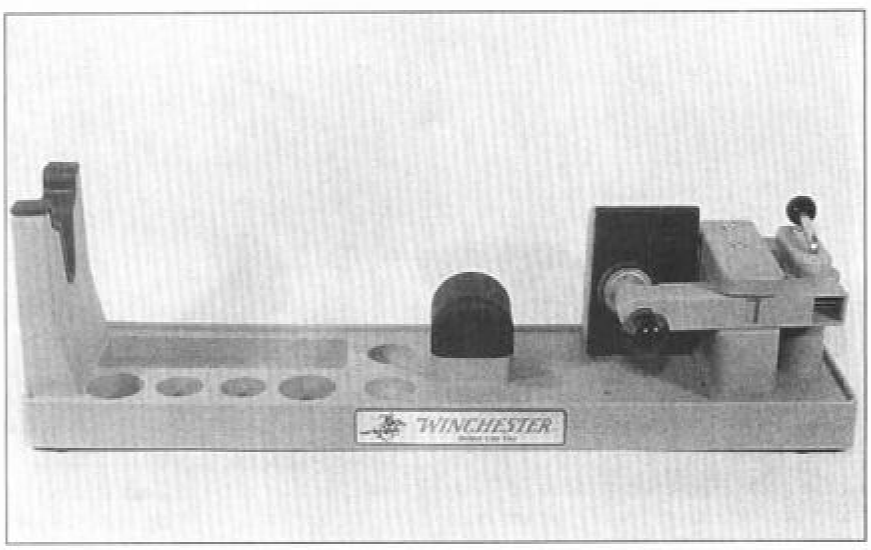
An additional holding tool you will find very useful is a cleaning cradle. Not so much for cleaning the barrel (unlike rifle barrels, on most shotguns the barrel comes off) as for scope mounting and working on the beads. Growing up, I learned cleaning and disassembly from my father. He learned from the Army, who taught him how to strip and clean a whole bunch of firearms, none of which were shotguns. And all this stripping and cleaning was done without a bench or cleaning cradle. My first day as a gunsmithing apprentice I looked at a cleaning cradle as if it had been beamed down from the starship Enterprise. By the end of the day I was converted, and would not be without one again.

With a bench and vise in your workshop, you next need disassembly and cleaning tools. A good set of screwdrivers is a must. The standard home screwdriver blade is too soft, too narrow, and too tapered to work on guns. The soft metal is cheaper and less likely to break, but deforms under a load. The narrow tip ensures it fits into any screw slot in the house, but defoms the edges of screw slots on guns. The tip's taper also ensures that it “fits” every screw slot, but acts as a lever to pry the screwdriver up out of the slot of a frozen screw. Unlike a home screwdriver set, which has four or five sizes, a gunsmithing set will have two dozen. A proper blade is hard. A hard blade will break before it bends, and not deform under a load. You should select a screwdriver blade that properly and tightly fits the screw on which you are working. And the tip must be hollow ground. The sides of the tip of a gunsmithing screwdriver are parallel. Unlike the home screwdriver which levers itself out of the slot, the gunsmithing screwdriver transmits all of its force to the screw.

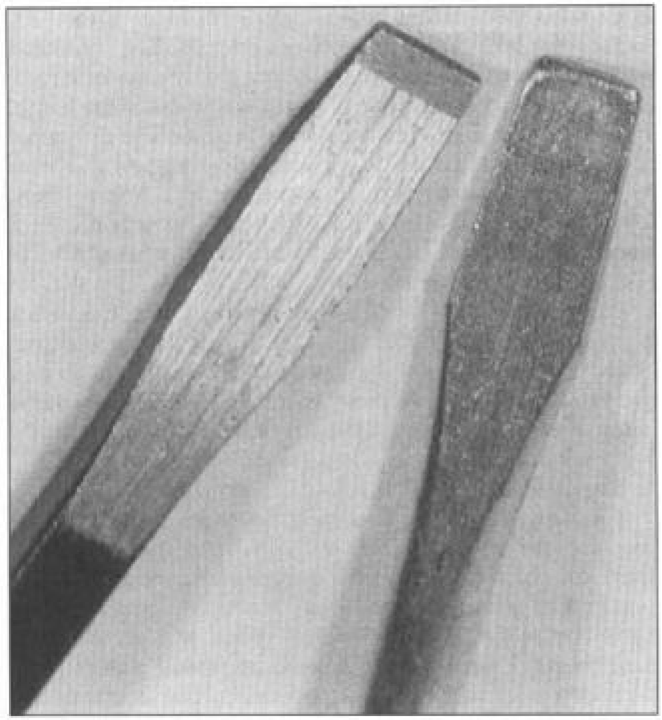
Professional gunsmiths commonly grind their own screwdriver blades. With a drawer full of candidates, if the working screwdrivers on the bench do not fit the screw at hand, they will pluck one out of the drawer and grind it to fit. As one example, Browning shotguns in general, and the A-5 in particular, will have screws with very narrow slots. You will have to grind screwdriver blades to fit. Even a gunsmithing screwdriver set with two dozen tips will not have any narrow enough for the Browning.



The best investment is one of good screwdrivers. A full set like this B-Square will work for 90% of the things you'll need.

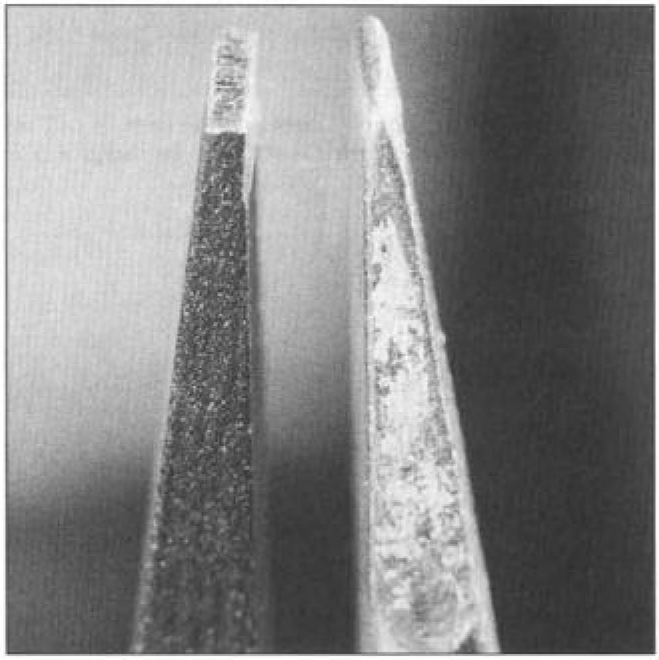


Likewise, take your cleaning cradle to the range to aid in cleaning while testing.



Household screwdrivers (the gray one on the right) are not meant for firearms. Either invest in the correct screwdrivers, or modify standard ones to fit.

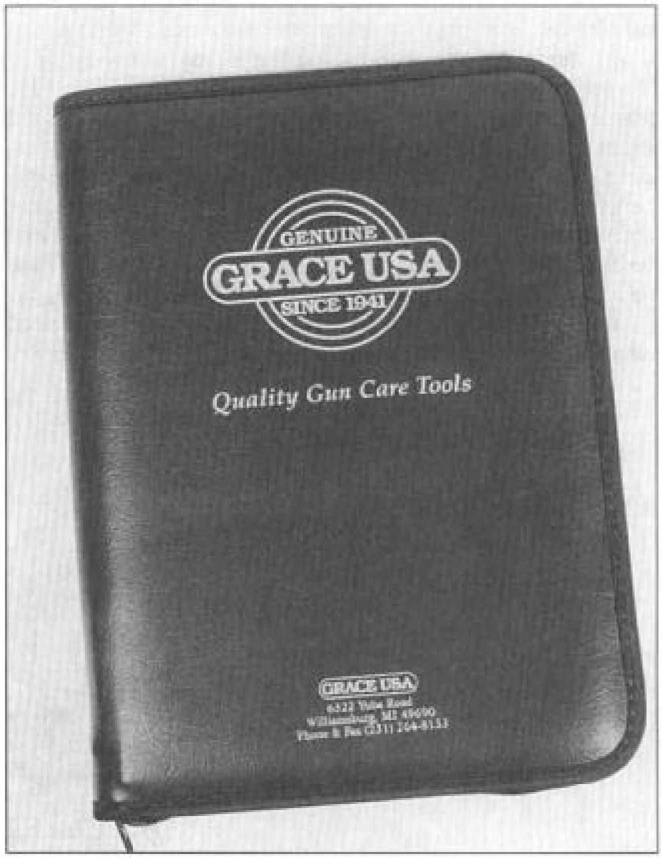
To grind your screwdrivers, the best tool is a bench grinder. However, bench grinders are noisy, heavy, expensive and messy. You can use a hand-held grinder to modify screwdrivers. Use a sanding drum in the grinder. Clamp the screwdriver in your vise with the tip sticking up 3 or 4 inches. Brace your hands against the vise and use the drum to narrow the tip and keep the sides parallel. Do not overheat the tip or you will soften it. If the tip turns blue, you've overheated it. The two solutions to a softened tip are to either heat it in a propane torch and quench it in oil, or grind the shaft back to hard steel and then grind a new tip in it.



You can see the rounded tip of the household screwdriver on the right. The gunsmithing screwdriver has parallel surfaces, and the tip is square for an even "bite" in the slot.

In addition to screwdrivers, you'll need drift punches. While older shotgun designs have a plethora of screws holding them together, many newer shotguns are assembled with push pins. The Remington 870 and 1100 for example, have but one screw, and that holds the stock on. The only other part that is threaded is the magazine cap, and you don't need a screwdriver for it. The drift punches can be used with a hammer, or pushed by hand, to drift pins out.

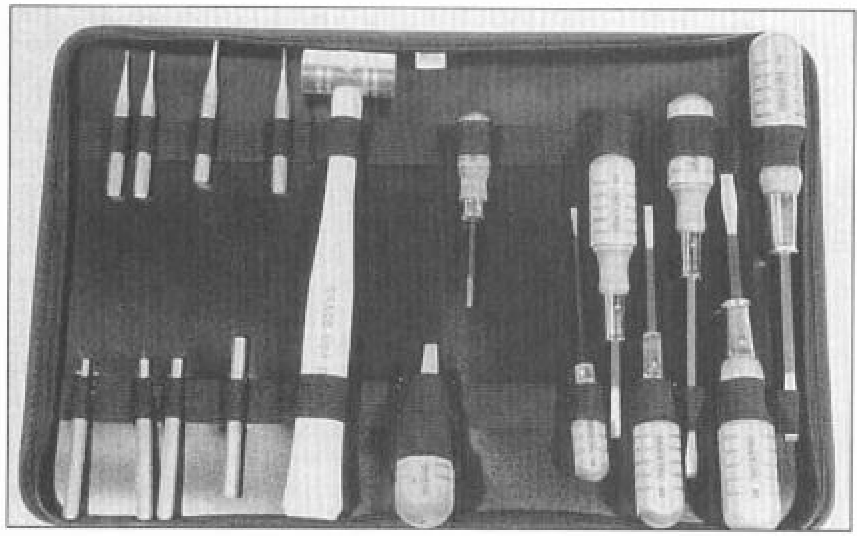
Once you shotgun is apart, you'll need cleaning tools for it. The barrel will require a cleaning rod with brushes and patch holders. While on a rifle a one-piece rod of hard steel is needed, on shotguns you can use the jointed rod. There are three reasons to use a one-piece rod in rifles. One, the rod is a tight fit in the bore. On a shotgun, even if you used a half-inch bar as a cleaning rod for a 20-gauge barrel it wouldn't come close to rubbing. Two, the edges of the joints can scrape the rifling and wear it. On a shotgun, the rod won't come close to the bore, and for most barrels there is no rifling. Three, the soft rod in a rifle can hold grit in its surface, grinding the vital throat and leade of the rifling. Again, on a shotgun, the rod doesn't come close, and there usually isn't rifling to worry about.



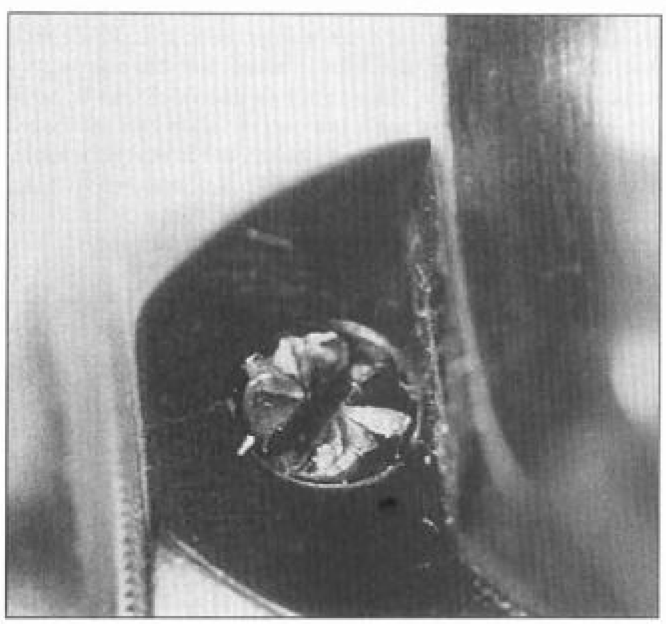
This is a very nice set of screwdrivers and drift punches, in their own carrying case.

A jointed rod is easier to store. Along with the rod, store your brushes, patches and swabs. To clean the barrel you'll need at least a bore brush. The bore brush scrubs the plastic, lead and powder fouling in your bore. A chamber brush is slightly larger and does the same for your chamber. If you get a dedicated chamber brush, mount it on a short handle and leave it there, if the chamber brush makes a trip down the bore it will get squeezed down (the brass ones, anyway) and will not be useful as a chamber brush. With the short rod you can't forget which one is which. Many owners of Remington 1100s and 11-87s also invest in a gas ring or barrel hanger brush. This brush is used to scrub the inside of the gas system enclosure on the guns. Instead of the gas system brush, I use a degreaser to suck the oils out, and then wire wheel the crusted gunk off. The wire wheel is an extra fine wheel from Brownells that fits my hand-held grinder. With the gunk

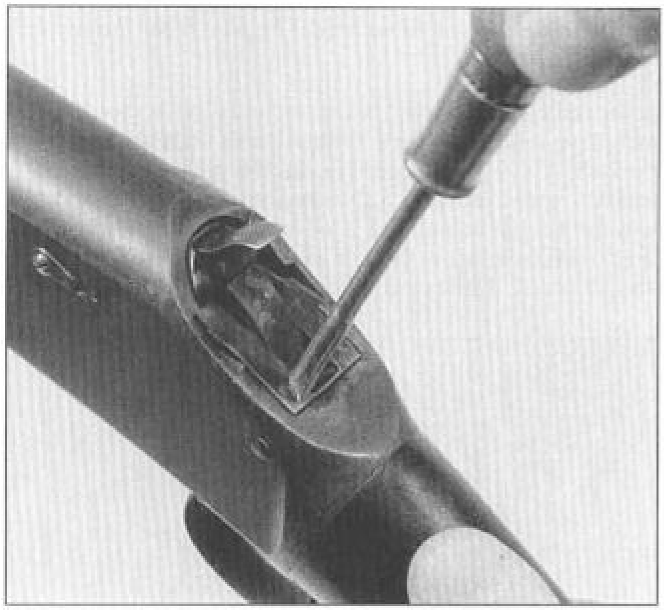
turned dry as dust, the wire wheel makes short work of any crusty gas system, and takes off any rust that might have formed underneath the gunk.



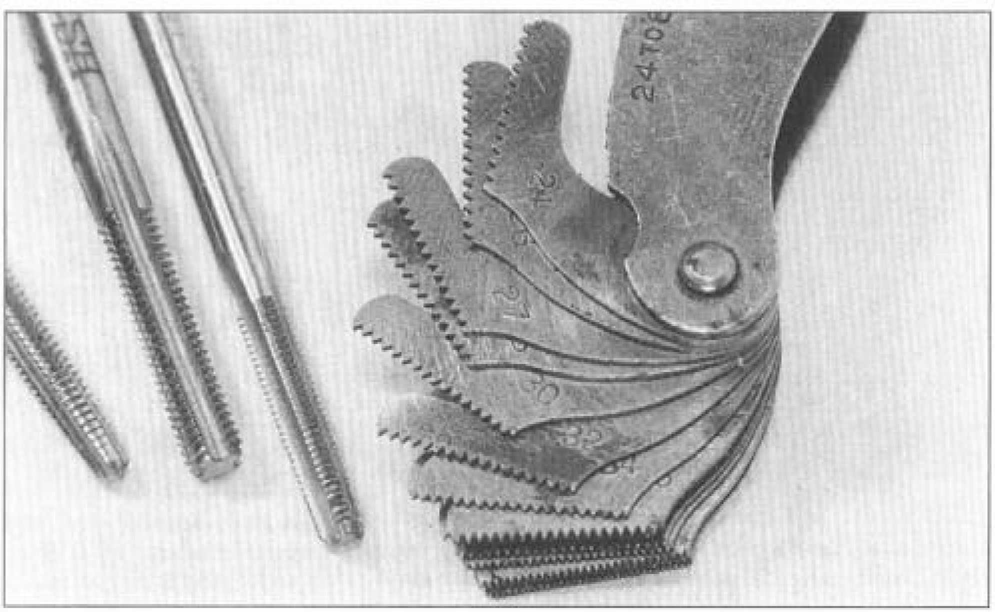
The Grace set, with properly-ground screwdrivers and brass drift punches. If you knarf your gun with these, you have no one to blame but yourself.



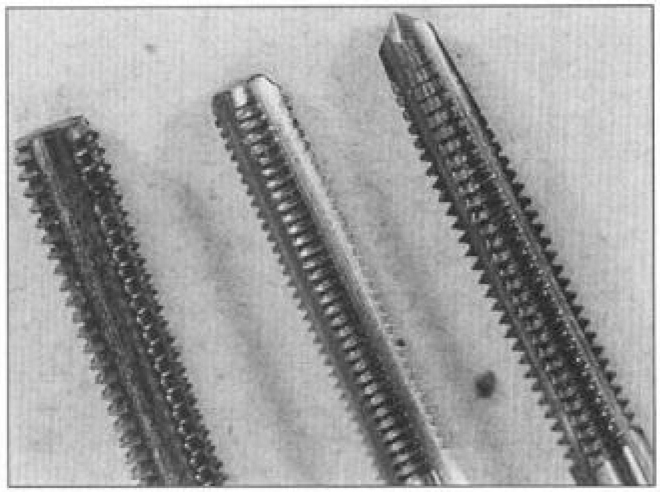
Here is a chewed-up screw slot. This is the result of using an improperly-fitting screwdriver.



With properly-fitting screwdrivers, no job is impossible. This Winchester was made in 1926, and probably hadn't been apart since then. The right screwdriver made things simple.



If you are drilling, you'll probably be tapping. You'll need taps and a thread gauge.



Taps come in three types, from right to left; taper, plug and bottoming. The taper is easy to start, and he bottom lets you tap to the bottom of a blind hole. The plug is for the inevitable compromises.

A minimum cleaning kit would be a rod and accessories and a cloth to wipe the shotgun down after you are done.

For the interior of the receiver and the trigger mechanism, a regular gun cleaning brush works fine. Usually with a green or black plastic handle, the original design of most brushes dates back to the introduction of the M-16.

All of this cleaning requires solvent. The customary method of providing a cleaning location and solvent supply is with a parts cleaning stand. The sink of the stand rests on a barrel of solvent, which is pumped up into the sink. The parts are scrubbed while in the stream of solvent. The solvent is usually mineral spirits, an inexpensive and non-flammable solvent that usually is reclaimed and has a small percentage of kerosene in it. Only the new, non-reclaimed solvent can be called odorless, and even it has a slight odor to it. Reclaimed solvent that has been used for a while will have a distinct odor to it. The odor is strong enough that on a regular basis we

would have people walk into the gunshop and ask “what is that smell?” It wasn't objectionable, but it was noticeable. Even after I would drive home for over half an hour with the truck windows open (tough to do in a Michigan winter) my girlfriend would comment “You smell like a gunsmith.”

A parts cleaning tank, with compressed air nozzle for blowing the solvent off is fast, convenient and messy. The Bassett hound is an option.

Small nicks and scratches can be touched-up with this Outers kit. Extensive bluing requires more of an investment in time, materials and space.

The solvent-soaked parts would be dried by blowing them with compressed air. Between the splashes from the parts washing stand and the compressed air blowing the gunk off, the corner of any shop that uses this method gets dirty. No, it gets grubby and crusted with gunk. And when the drum of solvent gets filled with powder residue, oil, bits of rust and gunk, it has to be properly disposed of. Even as an enthusiastic home gunsmith of your own guns it will take years to use up a drum of solvent, but sooner or later you will. You cannot simply dump the stuff down the drain. If you have the elbow room and can stand the mess, go ahead with a parts tank and solvent. Otherwise, you'll need a different method.

Instead of the smelly mineral spirits, use Brownells d'Solve. It is a concentrate that you mix with water to make a cleaning solvent. Before you

scream that water is the tool of the devil and will not come near your shotgun, consider that we will be using a blow dryer or heat gun to dry the parts, and penetrating lubricant to protect them. Mix your concentrate and scrub the parts in a sink or basin. Once clean, use the blower to dry them and immediately oil them with a penetrating oil to cover the parts and displace any residual water. You can filter the used solvent back into a storage jug, and when it is too nasty, cap the jug and take it off to the nearest landfill or recycling depot.

To scrub the bore you'll need bore solvent. Unlike the general cleaning solvent you will not need gallons of bore solvent. A quart will last you years. Keep the solvent in the bottle clean, and transfer the solvent to your cleaning patch or swab with an eyedropper or a clean patch. Don't just dunk the grubby swab or brush into the bottle, contaminating the solvent in the bottle. Unlike rifles, you will not need abrasive bore cleaning compounds to remove the fouling. The shotgun bore does not get exposed directly to copper as a rifle bore does. The only thing your bore is likely to see is plastic and powder residue. If you shoot slugs or buckshot, then there will be some lead. All of this will come out with a brush and solvent, or in extreme cases with a swab wrapped in brass kitchen cleaning mesh.

Which brings us to lubricants. Rather than petroleum-based lubricants I prefer synthetics. Petroleum-based lubricants are tough on wood. If your shotgun sits in the rack (as most do most of the time) the oils in it will settle in the rear of the receiver and come in contact with the stock. Petroleum products soaking into the wood soften the grain and lead to spongy wood that cracks. Synthetics will settle, but they won't attack the wood. I use Break Free, FP-10 and Rem Oil as light lubricants. For contact surfaces that need a more persistent lubricant, like sear tips and hammer hooks. I use Chip McCormick's Trigger Job. One jar will last a long time, even when you may have a bunch of guns to treat. My jar is so old it dates back to when he called it Trigger Slick, and I have used it on almost every firearm that came through the shop for work or repair in the years since.

Brownells d'Solve is a water-based cleaning solvent. Used in conjunction with a heat gun or blow dryer to evaporate the water, it is a convenient, odorless and non-toxic means of cleaning your shotguns.

Standard solvents and chemicals will do many things, but they won't strip old finish off. Especially the finish on Browning shotguns. Consider the cost of extra supplies if you want to do the job yourself or send it out.

If you are going to go past simple disassembly and cleaning, you'll need more tools. To strike some of the tools you'll need a hammer. A ball peen hammer of a medium weight, 8 to 12 ounces should be enough. For filing, the most useful file I have found is Brownells Swiss pattern, 8-inch extra narrow pillar file, #2 cut. It is large enough that you can get a good hold on it. It is small enough that you can get to places you couldn't with a large file. The #2 cut is a medium-fine cut, but the file can be used to remove large amounts of material and still finish with a smooth surface. The only drawback to the file is its flexibility. You can press on it hard enough to bend it, and if you aren't careful you'll file a rounded cut instead of a flat cut.

If you need a larger, heavier (non-bending) or coarser file, then get an American pattern Mill file, second cut of 8 or 10 inches long. It will be stiff enough that it won't bend, which is also useful as a backer when sanding.

For woodworking, get a cabinetmaker's rasp. The two files I mentioned are too fine for wood, and will fill up with wood after a couple of passes.

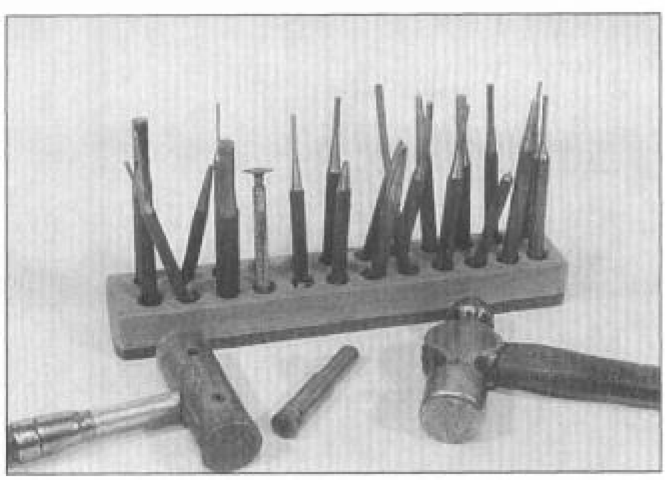
Buy as much lubricant as you think you'll need, and then some. You can get quantities from the ⅔ of an ounce to a full gallon.

To keep your files clean and properly cutting, get a file card. The one we're discussing is a flat piece of wood with short brass or bronze bristles used to card or comb the filings out of the teeth of the file. If you don't remove the filings, the file loads up and stops cutting. Before it stops cutting, the partially-loaded file cuts unevenly and makes a mess of the surface you are creating. The rasp will also need regular cleaning to keep your woodwork smooth.

If you are filing metal, filing talc makes the job messier but makes the filing easier. The talc slows down the accumulation of filings in the teeth of the file, reducing the need for carding. It also creates a mess. File the talc to load the file up, then file the metal. When you're done, sweep and vacuum up the mess, and wipe your shoes off.

For high-pressure areas such as sear tips and hammer hooks, a persistent lubricant is a must. Chip McCormick now calls his product "Trigger Job" but it still works great. A small jar is probably a lifetime supply.

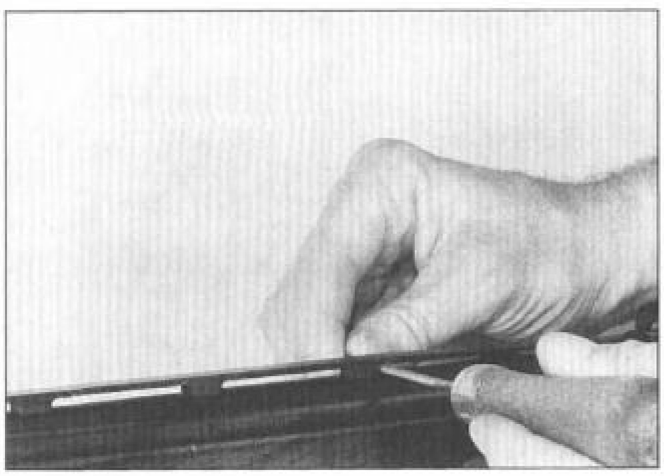
Drilling holes requires drill bits, regardless of the kind of drill you are using. If you keep all of your drills in a small box, it is slightly better than letting them wander around on the bench. Keep them in small envelopes in the box, or get a drill organizer to keen them sorted and handy.



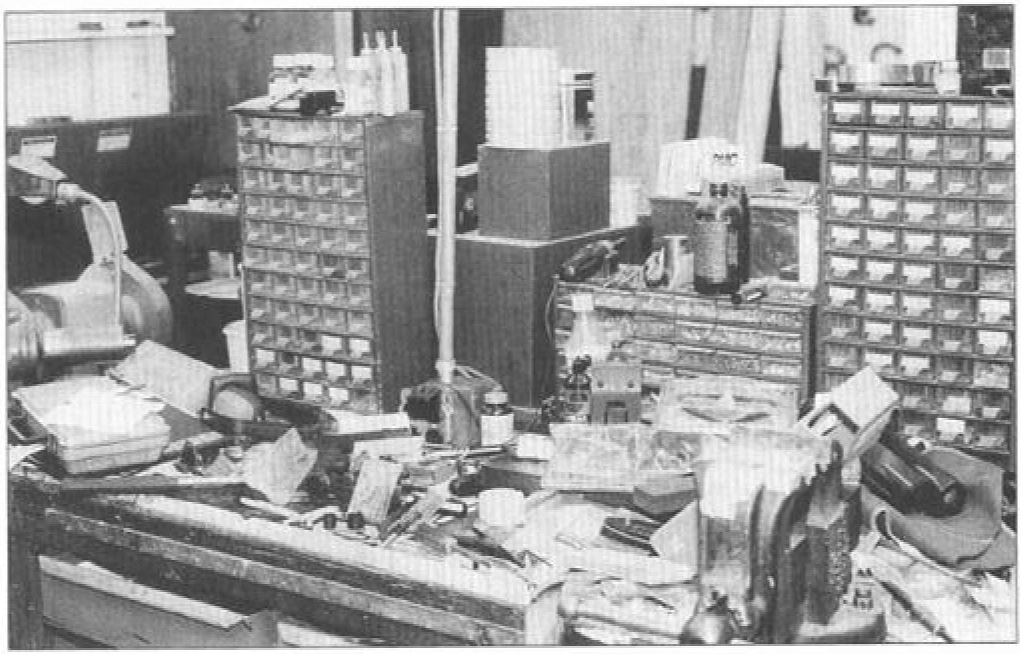
Hammers and drift punches are a must. Many shotguns will have pins holding things together.

You've got the bench, lights, vise, cleaning equipment and tools. Keep them organized. Don't “store” your tools in a heap on the end of the bench or in the corner. The cutting tools with get nicked and dulled, the polishing tools will get gouged and scratched and will not polish properly and your cleaning rods will get bent. At the very least, keep them in the boxes they were shipped in, and store the boxes on a shelf away from the bench. Better yet, get some plastic tool organizer boxes from the big-box hardware store or chain, and store your tools in the boxes. If you want, you can write an inventory list to keep track, but that is going a little overboard. Keep small accessory parts in a box and with the fixture they go to. Mark their box so you don't have to open it to remember what's in it.

Clean off your tools before you put them away. Card your files clean and wipe cleaning solvent off of the cleaning rods and tips before storing them.

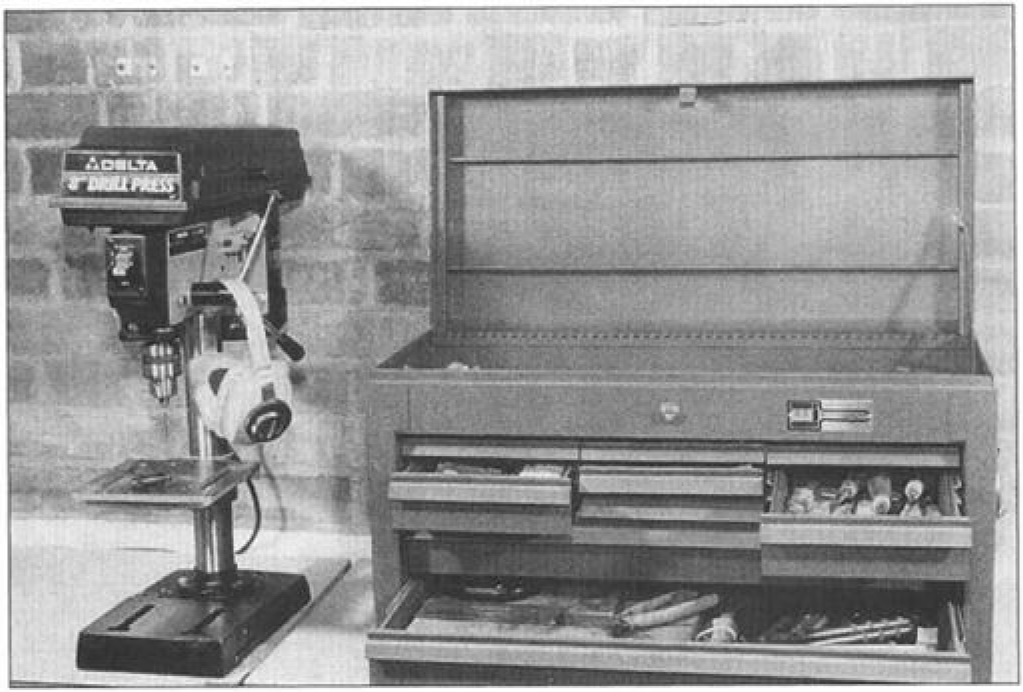


You need the right file for the job. One file cannot do everything, but some come closer than others.



You should not leave your bench a mess. I did so in the past, but found a clean bench was much easier on the nerves. And, I could find things I had dropped!

For power equipment, the aforementioned bench grinder is very useful. But it is noisy, messy, loud and expensive. In the house the bench grinder is a hassle. The ground particles of metal combine with the grit from the wheel to make a persistent powder that not only gets rugs and floors dirty, but can grind the finish off a floor. With a sanding disk a bench grinder can be used in lieu of a belt sander to fit a pad, but the mess increases exponentially. The rubber dust of the pad flies around the room and gets on the walls, ceiling and the floor. You end up coated with the dust and track it wherever you go. If you have an extra bench in the garage you can exile the bench grinder out there and use it as needed, otherwise forego the bench grinder. An equally useful and more fastidious power tool is the drill press. The biggest drill presses have their own floor stand, but you can do almost everything on a model that stands on the bench. Make sure you get one that is tall enough between quill and plate, as the setup for drilling a shotgun quickly eats up space. At a minimum, you want a drill press with 14 inches between tip of the chuck and the baseplate.



A good tool chest is very useful for storing your tools, parts and fixtures. This Kennedy box is lockable and expensive, but even a cheap plastic box is better than an unorganized cardboard box full of loose stuff.

A variable speed drill is a must if you are going to polish your bore, chamber or chokes. To drill the stock for a pad installation, sling swivel installation or to repair a crack, it is indispensable.

And a hand-held grinder is vital for some repairs. A grinder like the Dremel tool, or my ancient grinder made by a company that went out of business before the Beatles broke up is just the ticket for fixing a cracked forearm.

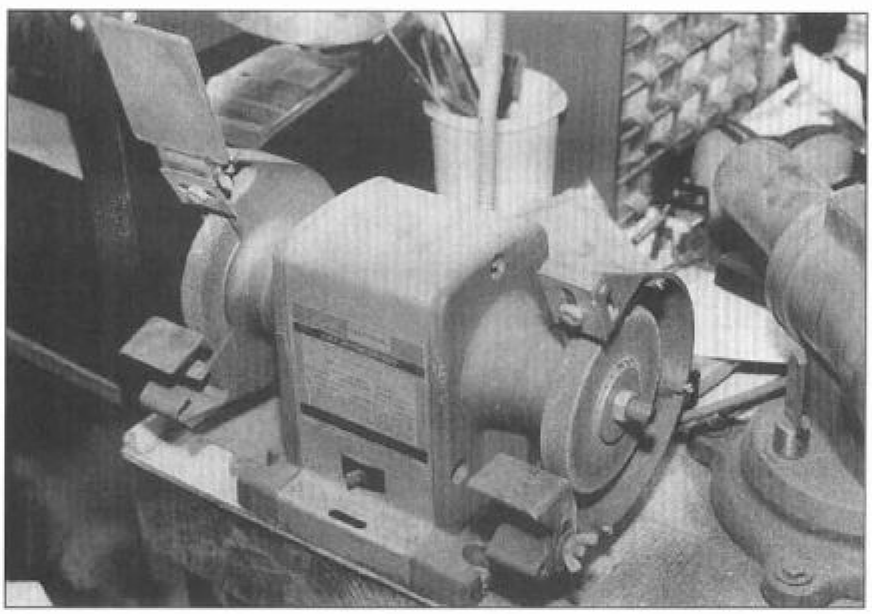
The big machine tools are nice but beyond the scope of the home gunsmith. While a lathe or mill can be very useful for some jobs, you have to ask yourself a few hard questions. “How will I pay for this?” “How many jobs will I have to do to cover the cost?” and “How long will it take?” Even a professional may not invest in such equipment, if he (or she, let's not be snobby about this) cannot recover the cost in a reasonable time. Many gunsmiths send their own guns to other gunsmiths for work. You should not be bashful about doing the same. For all the years I was a professional gunsmith, I never considered welding. I had a couple of good welders nearby who not only knew guns but took directions well (an important

consideration) and I didn't have the time to learn. And after all, the point is to fix your guns, not to learn how to become a lathe operator for the few times a year you might need the use of a lathe.

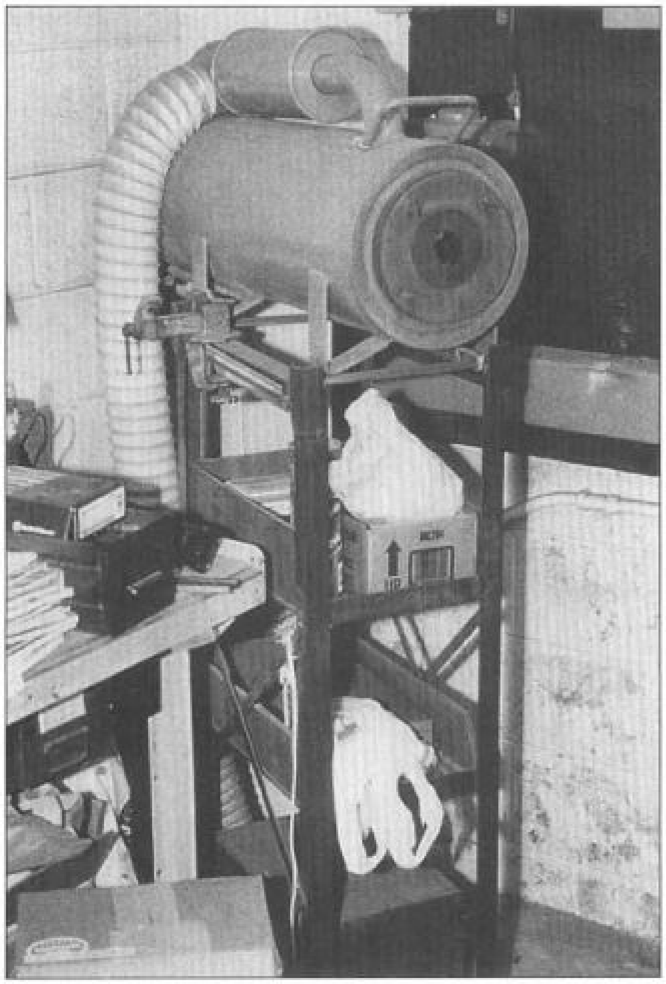
If you invest in a full parts cabinet, you can not only store all of your tools in one place, but you can lock the cabinet.

You will need some place to store all this gear, and a place to do your work. Even a simple disassembly and cleaning can create family strains if done on the kitchen table. Imagine the hell to pay trying to refinish a stock, or install some sling swivels! The best solution is a spare room in your house, or if you have a large and dry basement, down there. Set up your bench in a corner that is not obstructed with pipes, and has power outlets nearby. A spare room used as a gunsmithing room should have its own lock on the door. If you use a corner of the basement or garage, consider storage cabinets to get everything out of sight. If at all possible, use the basement

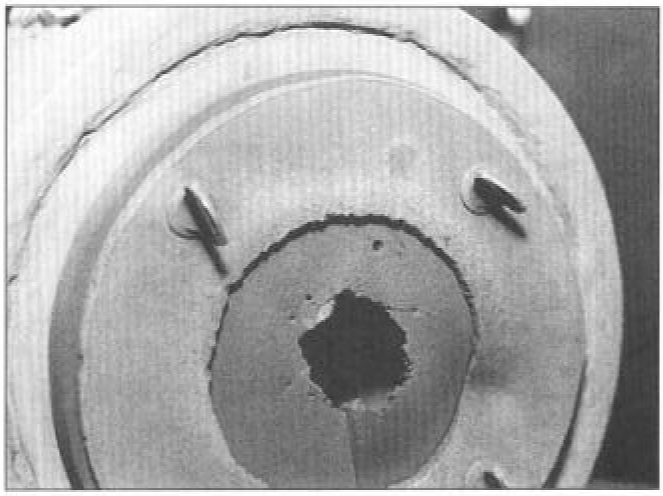
instead of the garage. Garages are open to public view each time you enter or exit with your car. Cars bring water and dirt in with them. If you have extra tools, they are handy to force open your cabinets. Wherever you set up your shop, the guns themselves should be locked up. Even before the wave of litigation about proper storage, it was prudent to keep your guns locked up. Now, you may even have insurance requirements mandating it. A good safe will cost as much as a good gun, but will do what one more gun can't Protect the other ones. A good safe is going to be the size and weight of your workbench, and should be just as portable. That is, not at all portable. Buy a good safe, but don't worry about getting a fireproof one. A friend of mine had his house burn down, and his gun safes ended up sitting in the coals while the firemen hosed the smoldering embers. The guns were steamed but fine. One more strike against the garage: a safe in a garage sticks out like a sore thumb. It is obvious to anyone who sees it. Set up in the basement or a spare room!



For some jobs, nothing but a bench grinder will do. But it is noisy and messy. Best to use it only in a dedicated room, or banish it out to the garage.

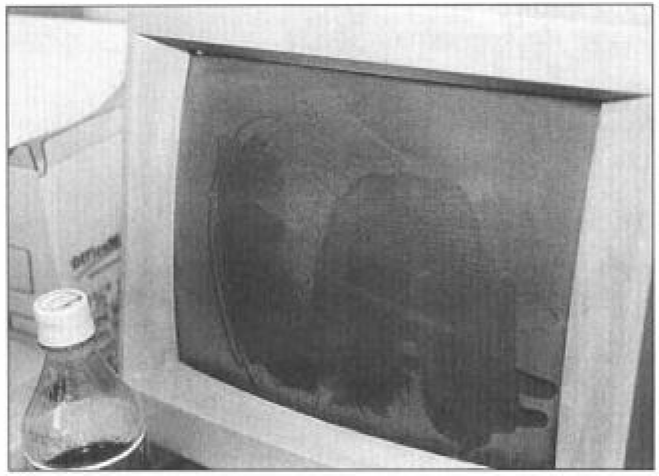


One thing many professionals have that you won't need is a bullet trap. Used for test-firing, even this one with an exhaust pump and filter is messy. Be patient and schedule range trips for your test-firing.

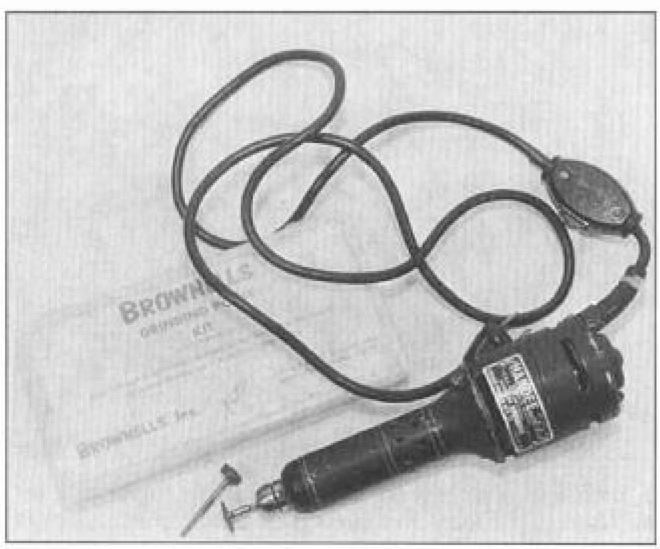


If you'll look closely at the face of this bullet trap, you'll see the results of a four-shot burst from a malfunctioning .45 ACP. Messy and exciting!

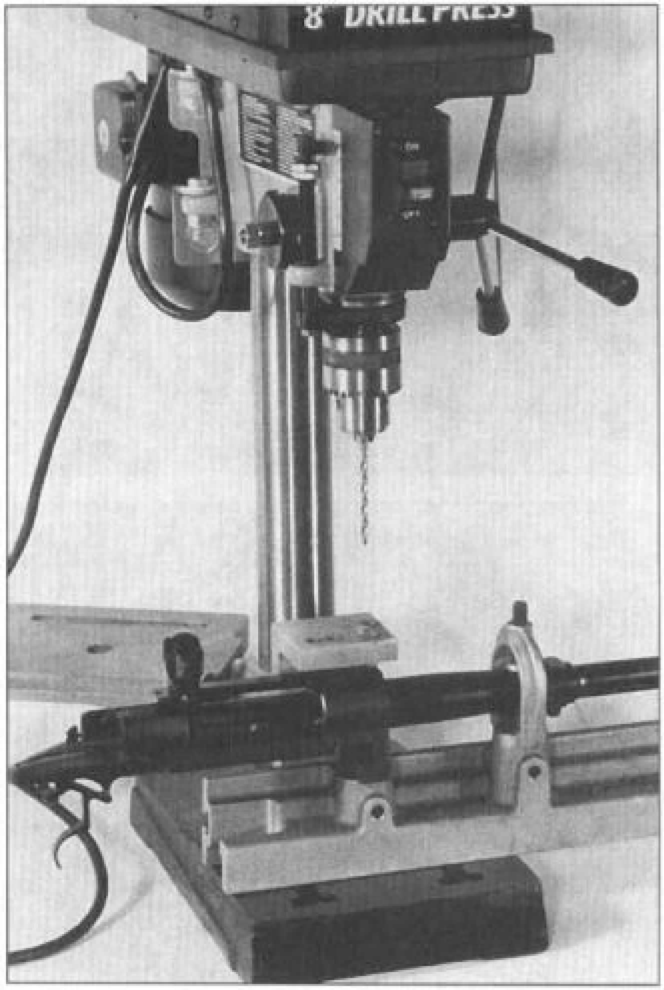
Some things you can do with a hand-held variable speed drill. But there are many things you cannot, and for those jobs you need a drill press.



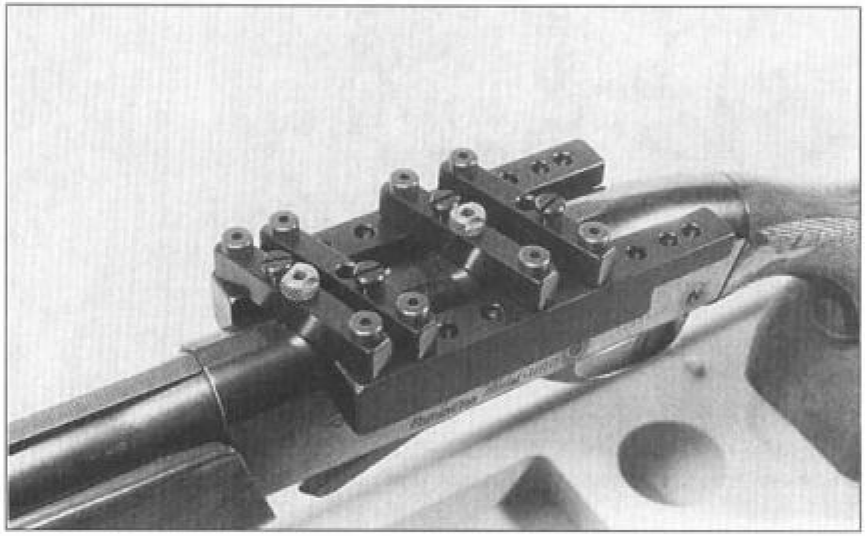
Between the dust from a bench grinder, belt-sander and bullet trap, this computer monitor has gotten so grubby it needs more than some light dusting. This is proof of the need for a dedicated space if you do more than just disassembly and cleaning.



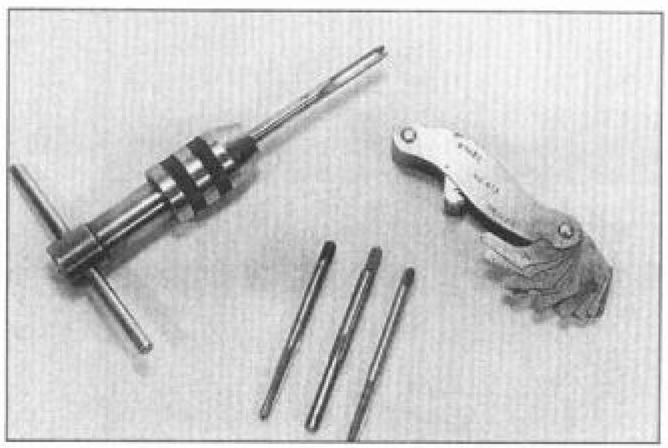
A hand-held grinder can be very useful. When you buy grinding and polishing wheels for it, buy a bunch. If you break or lose your one-and-only, you'll have to wait until its replacement shows up.



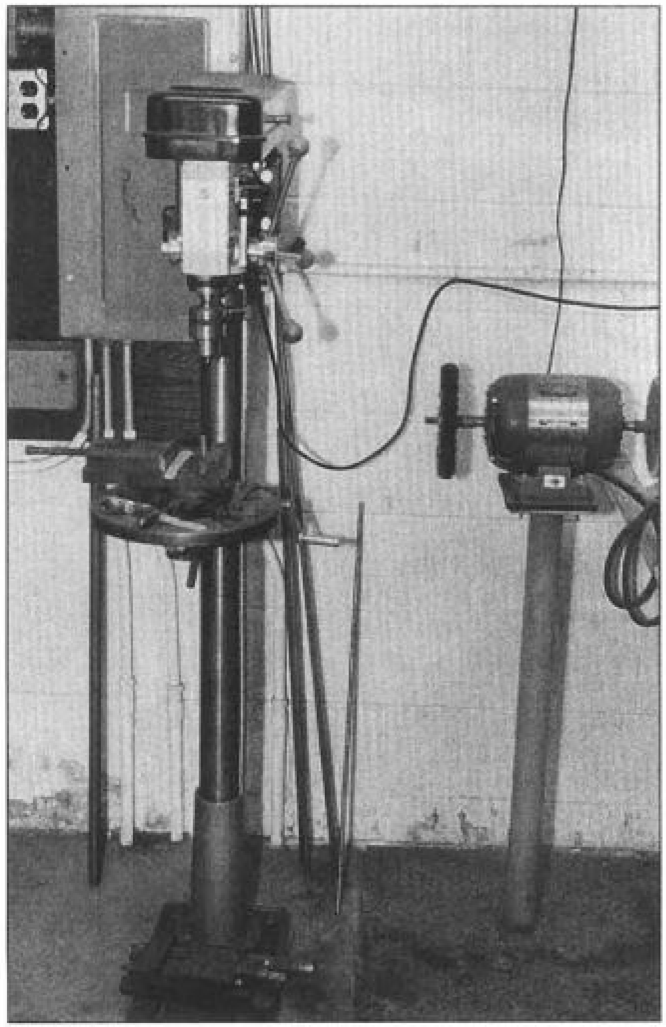
For most everything you'll do, a bench-top drill press is enough. Make sure there is enough space between baseplate and quill to fit your fixtures.



Fixtures make jobs go faster and easier. This Williams scope mount drilling jig is just the ticket if you're going to drill and tap several shotguns. If you only plan one, it will be easy but expensive.



Taps require handles. Without the handle, you can't turn the tap with enough force to cut metal.



Do you really need the extra cost of a floor-mount drill press? Next to this one is a buffer & wire wheel. It is almost as messy as a bench grinder.

Soldering requires heat. Light jobs can be done with a propane torch, bigger ones require an acetylene torch. (Not to be confused with an oxy-acetylene welding torch.) Any time you are applying heat, keep a fire extinguisher on hand.

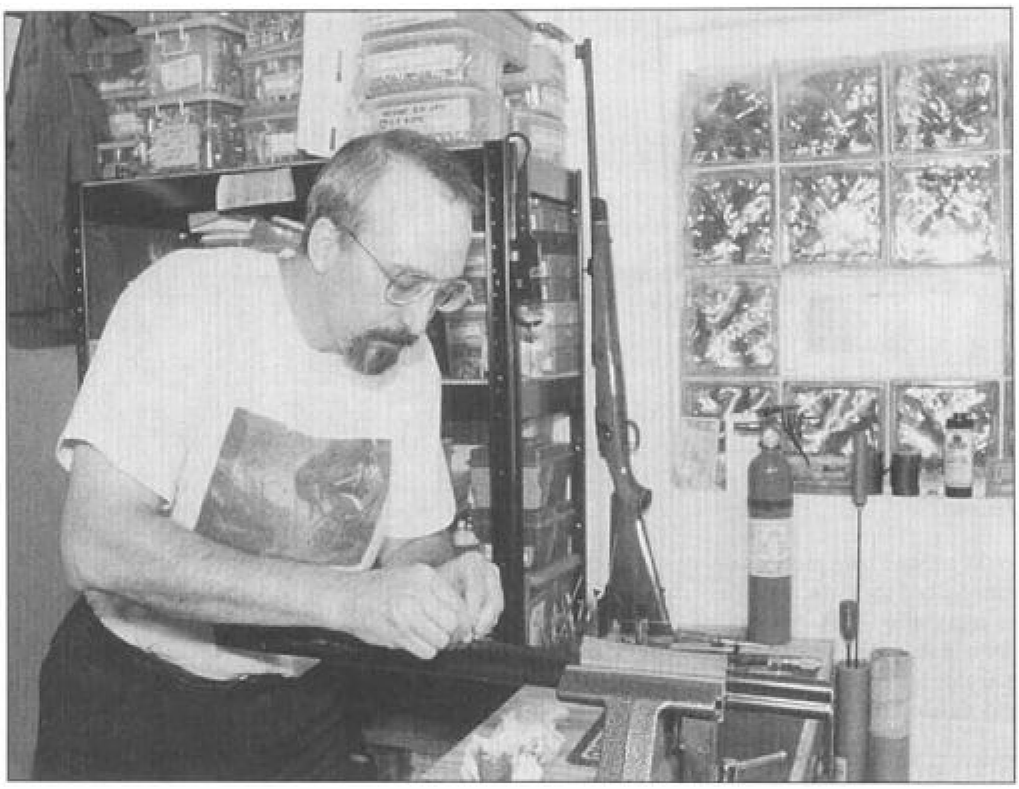
With a safe in your work room, bolt it to the floor or walls, and add weight to it. In addition to the bolts, a couple hundred pounds of lead shot ensures the immovability of your safe. And you do have to store your shot for reloading someplace, right?

The Learning Curve

The way to learn is to do. But “doing” for the first time on an expensive shotgun, or a family heirloom, can be a nerve-wracking experience. Rather than subject yourself to the tension, get a practice gun. Hike off to a gun show (assuming the powers that be in Washington let us do such things in the future) and walk the aisles. While an exact duplicate of your shotgun would be great, it doesn't have to be the same gun unless you are working on something type-specific. Don't worry about condition and features, because you will be using the new-old gun as your practice canvas.

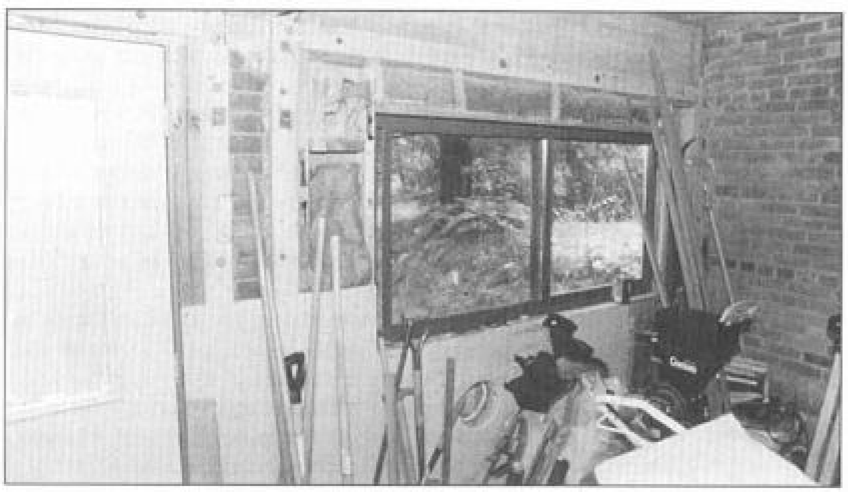
If the paperwork is too onerous, or you just don't want to buy another shotgun, then pick up some parts. A stock and barrel will work as the bare minimum.

With your practice gun or parts on hand, you can work away to your heart's content, safe in the knowledge that whatever happens can't hurt your Dad's shotgun handed down to you.



With your own workspace, you don't have to worry about spilling oil and solvents on the kitchen table. A bench at the correct height makes the work less tiring. (The .458 in the corner is in case of marauding bears in the suburbs. The fact that there aren't any is proof of its effectiveness.)

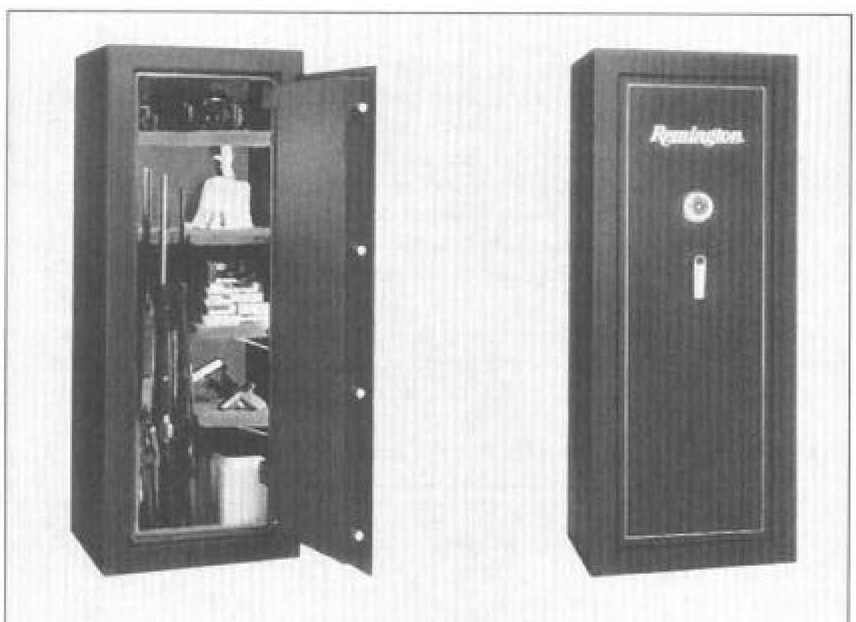
A clean and well laid out work bench makes the work go easy.



A garage may be convenient, but it is also drafty, humid, open to observation, and not secure. Many garages are also cluttered even before you move your gunsmithing stuff in.

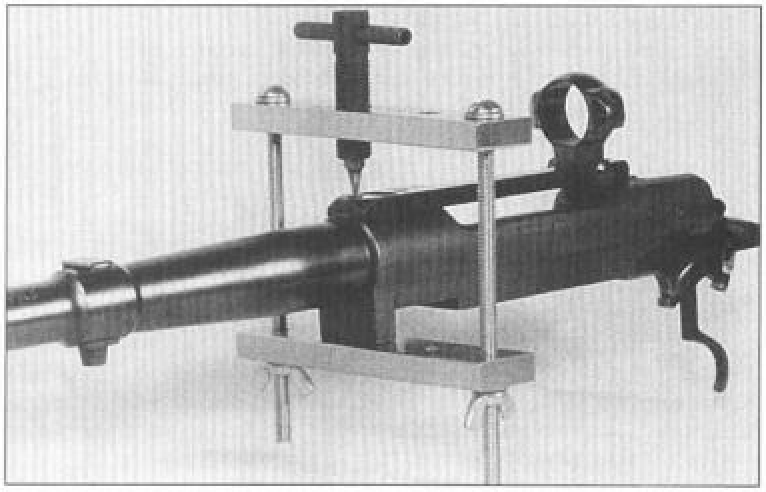
REMINGTON TROPHY SAFE

You should store your guns in a lockable container. For the cost of one gun, you can protect many. (Photo courtesy Remington Arms Co.)

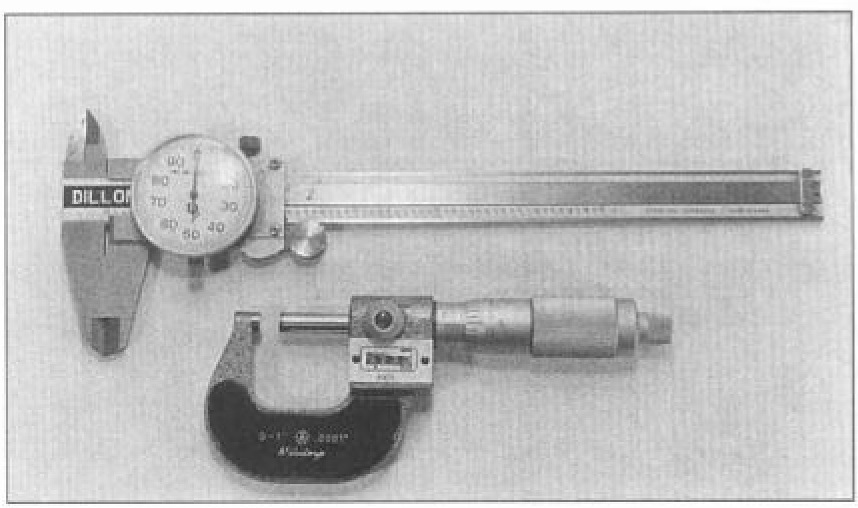


NEW REMINGTON GUN SAFES
SPORTSMAN SERIES

Even a small and inexpensive safe is better than none at all. And in some jurisdictions, it may be legally and insurance-wise a necessary investment. (photo courtesy Remington Arms Co.)



Some things make life much easier. To remove a frozen screw without a screw jack is a big hassle. With it, the job is easy. If the screw resists the jack, then off to the drill press.



Buy good measuring tools and treat them properly. Store them in your tool chest and do not set heavy things down on them.

A couple of generations ago, if you wanted to be a gunsmith, the first thing you would have to do is make the tools of gunsmithing. Anything that wasn't a standard machine-shop tool was something you would have to make. Most gunsmiths still do the basic things, like grinding their own screwdrivers, but hardly anyone fabricates their own fixtures. Why would they? Unless it is a one-of-a-kind job, or no one has thought of it before, the hours of design and fabrication, testing and altering take up a lot more time than just buying the right tool. And the business has gotten so big that some shops only make the tools to do gunsmithing, having given up gunsmithing entirely.

If you wanted to find just the right tool for each job, you could send off for the catalog of every manufacturer of gunsmithing equipment and pore through them. You'd end up with a file about a foot thick, and you would still not cover them all. Instead of all that hassle, send off for the Brownells catalog. It will be the best five bucks you've spent in a long time, maybe ever. Not only will there be more goodies in it than you can afford without winning the lottery, but you can order them all from one place.

Brownells has been at it for a while, as the current catalog (in 2000) is the 52nd. In James V. Howe's “The Modern Gunsmith” (first edition 1934, last updated in 1954, and anything but modern now) Brownells is listed as a source of supplies. The list is not long, but they are at the top. As an aside, Howe was published by Funk & Wag-nail's, and I'd wager a very nice shotgun that it has been years since there was anything to do with firearms in their title list. The late Bob Brownell started offering other makers' tools and supplies right after World War II, and put together a catalog to list the goodies.

You can spend many an interesting evening just flipping through the latest catalog, and find something on every other page that may make you think “I never knew you needed something like that!” Once you have your list narrowed down, you can call, write or e-mail and expect your parts on your doorstep within a few days.

If you've ordered something, and the complete instructions just aren't clear enough, phone Brownells and ask for the experts. On hand will be experienced professional gunsmiths who have the best job in the world. They get to play with all the toys so they can explain anything you need to know. All of them have worked in gunshops or gunsmithing shops before

they got the neat job of working with fellow gunsmiths and playing with the toys.

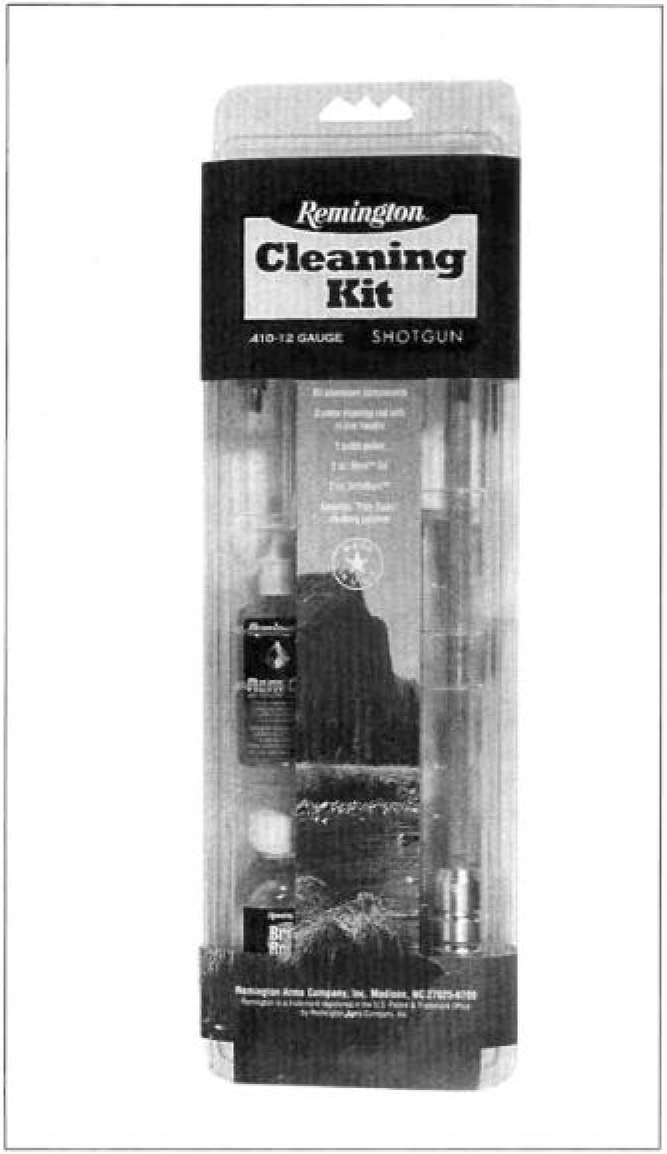
Tools and parts are grouped by their use or type of firearm, so you don't have to flip through the whole thing to find each entry for a particular application. Each entry includes a clear photograph of the part or tool, so you can see exactly what you are getting.

Recently Brownells expanded their offerings, and the catalog, greatly. They now offer factory parts for 17 different manufacturers. How I wish they had started back when I was working on guns for a living! Often, the price of a job was not dictated by the price of the part, but the price of the shipping and handling, or the minimum order limit from a manufacturer. Now, if you need a particular screw, pin or part for a shotgun, you can add it to your regular order from Brownells. What, you don't make regular orders from Brownells? Just wait.

If you can't find it in Brownells, you'll probably have to make it yourself. If you do make a useful gadget, Brownells may want to carry it. Brownells is Christmas catalog for gunsmiths and shooters. It costs less than a movie ticket and delivers much more enjoyment than many "Blockbusters" do.

Chapter 4
Shotgun Types and Their Maintenance

Once it has been manufactured, every shotgun seems to spend the rest of its existence as a magnet for dirt, dust, rust, powder residue and clumsy relatives. Even sitting quietly in a locked cabinet or safe, a shotgun will collect dust. Handling your shotgun, you place water and oils from your hands and face onto the stock, forearm and steel. Taking your shotgun out into the woods, or to the gun club, exposes it to changes in temperature and humidity. Sunlight warms it and the AC in your car cools it. Rain, snow, fog and dew all conspire to get your shotgun wet. Shooting your shotgun deposits plastic and lead in the bore, powder residue in the chamber and action, and more sweat and skin oils on the wood and steel.

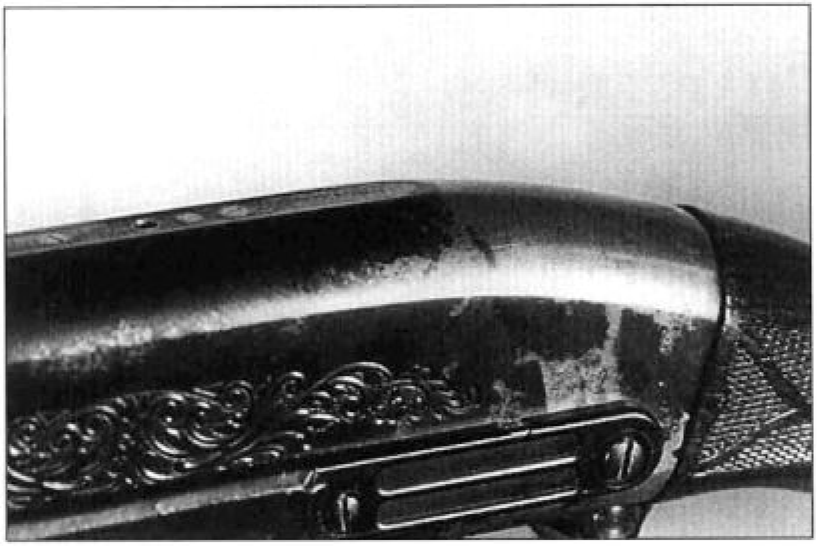


Do not skimp on a cleaning rod. You can get by with a rifle rod and an adapter, but a shotgun rod is better for use in shotguns.

It is false economy to be sparing in your use of cleaning solvents and oil. Get the best and use them as needed. These small bottles represent a multi-year supply of solvent and oil even when used excessively.

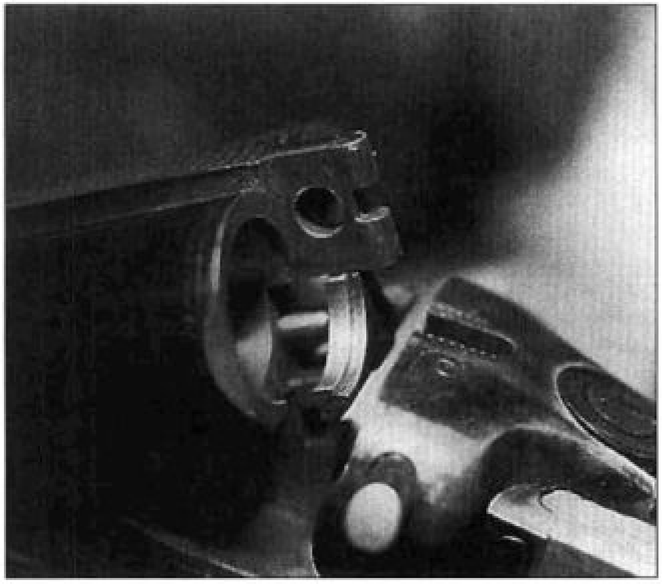
All of these things can be cleaned off at no harm to your shotgun. But if neglected, shotguns will rust. Rust can be cleaned off your shotgun, but at a cost. The three levels of rust are: spotting, cleaned off with little or no evidence of its existence: flaking, which can be cleaned off but leaves bare spots where the bluing has been removed; and pitting, which when removed leaves as its evidence steel that is destroyed.

Regular inspection and cleaning of your shotgun will prevent rust. If for some reason your shotgun does rust, the rust can be removed. Rust works the same way on all shotguns, as a chemical reaction between water and the steel, creating oxidized steel. How to clean your shotgun depends on what type it is.



Rust is the enemy, and your hands can cause it. The salt and oils in your skin can strip bluing off, as they have on this shotgun.

Shotguns come in a variety of action types. The most common ones are single-shot, doubles, pumps and semi-autos. For a while there was a number of inexpensive bolt-action shotguns made, but they are rarely seen today. One was even a modified bolt-action rifle. After The War to End All Wars (before we got into the habit of numbering them), Germany was left in a shambles. They had to pay reparations to the Allied powers, their civilian economy was non-existent after four years of war. The only things they had in excess were rifles. Too bad, because so did everyone else. However, by modifying the bolt-action Mauser and fitting a shotgun barrel to it, they could sell their surplus rifles as two-shot shotguns. The market for such guns was always small, and disappeared in the early 1960s. If you see a bolt-action shotgun today, it is almost certainly to be a slug gun, designed to be a “shotgun” for deer hunting. With a rifled barrel it can shoot as accurately as some rifles. The only thing it has in common with the inexpensive bolt actions of an earlier age is the handle on the side.



This Belgian shotgun uses a rod through the center extension as a locking method.

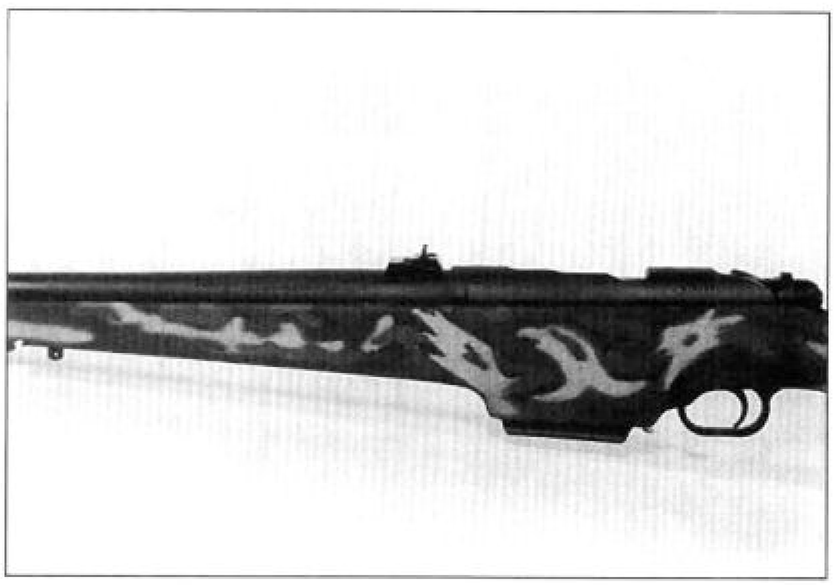
Older bolt-action shotguns were made to be inexpensive, but can be re-built beyond their earlier expectations.

Safety Measures And Handling

The purpose of a shotgun is to launch a payload of shot. At close range, the destructive power of a shotgun is most impressive. The shot can blast

through many building materials, and make a terrifying mess on the other side.

The first thing you always do is make sure the shotgun is unloaded. The second thing is to make sure there are no loaded shells anywhere near. The third thing is to continually check to make sure the shotgun hasn't gotten loaded since you last checked. Even if that last check was a couple of minutes ago. Your best example in this habit would be a group of practical shooters. They are used to handling, loading and unloading firearms on a regular basis. If one is showing a shotgun to his buddies, each of them will check to make sure it isn't loaded, even after seeing all the others in the group do so. Your worst example would be some of the customers any gunshop gets. Bringing a shotgun in for sale, appraisal or repair, customers will always tell the clerk "It isn't loaded." When I was working at a commercial shop, we could hardly go a month without working the action and throwing a loaded round out onto the counter or floor.



The modern bolt-action shotgun, with a rifled barrel, is an accurate slug-shooting machine.

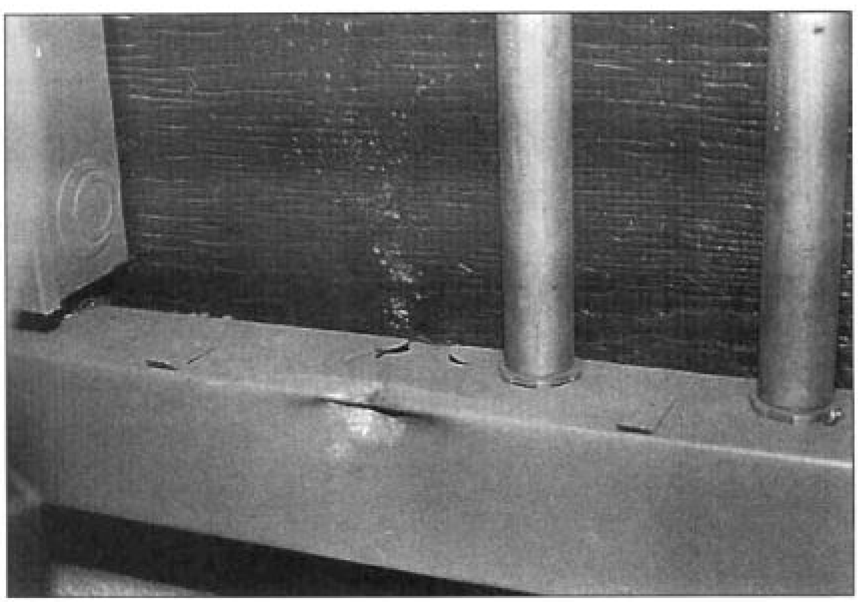
When you go to check the chamber on pumps, open the action using the slide stop. Usually located on the front or rear of the triggerguard, it unlocks the action without dry-firing it Run the slide all the way back. On autos, grasp the operating handle and rack the bolt back until it locks. Look into

the chamber, and press a fingertip against the magazine follower. Once you are satisfied it is unloaded, then proceed. Even after you have checked, maintain the habit of keeping the muzzle pointed in a safe direction for disassembly and maintenance

For cleaning you can divide a shotgun into its three basic components: The barrel or barrels, the action, and the stock and forearm. Each will require its own tools and cleaning compounds. If your shotgun has a barrel that does not detach from the receiver you will need to treat it like a rifle. Two examples of such a shotgun are the Mossberg 512, and the Browning A-Bolt Stalker. Get a rifle cleaning cradle, it will make your life much easier.

You will need a cleaning rod, brushes and patches for the bore. Also, you wilt need cleaning solvents to dissolve the powder residue, plastic and lead that coat your bore. The selection of a cleaning rod for your shotgun is not as critical as it is for a rifle. The rod for a shotgun is not nearly large enough to touch the bore, let alone rub it hard enough to cause significant wear. I use the jointed aluminum rods because they are cheap. So cheap that when I was working commercially I didn't switch brushes or swabs. We bought and sold many used shotguns, and it seemed like every other one we bought had either extra shells or a cleaning kit with it. I simply set up a shelf with rods assembled for each gauge, one rod with a brush and one with a swab. You needn't go that far. One rod will do. For a cleaning solvent, Shooter's Choice or Birch-wood Casey powder or nitro solvents work nicely. As a lubricant and after cleaning, use Break Free or FP-10. The hinge pin of a single or double-barreled shotgun works hard, and I use a high pressure grease to lubricate it.

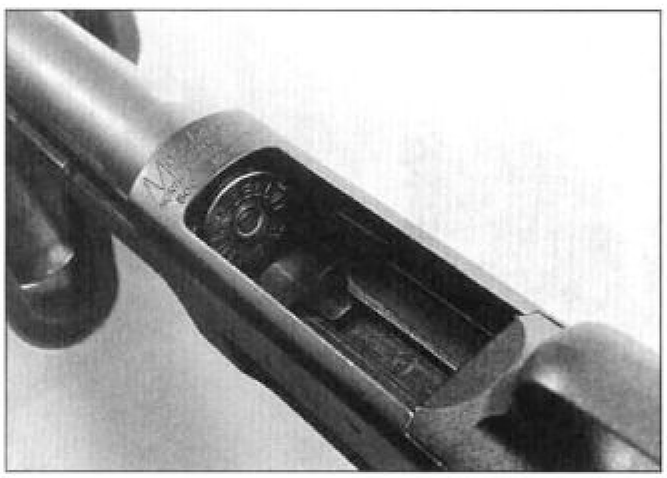
Always check to be sure a shotgun is unloaded before you work on it.



Make sure it isn't loaded! This electrical box took a hit from a 16 gauge ⅞ oz load at two feel. Startling? You bet!

To disassemble the action you will need either drift punches that fit the pins holding your shotgun together, or correctly-fitting screwdrivers. Shotguns, especially imported doubles, have some of the narrowest screw head slots you will ever see. Within a week of starting out as a gunsmith, I had ground a set a screwdrivers to use when working on Browning A-5s. The slots were so narrow that none of the ones I had on hand would even come close to fitting. Once I ground them, I placed them in the Browning A-5 parts drawer, so they wouldn't get used for any other shotgun.

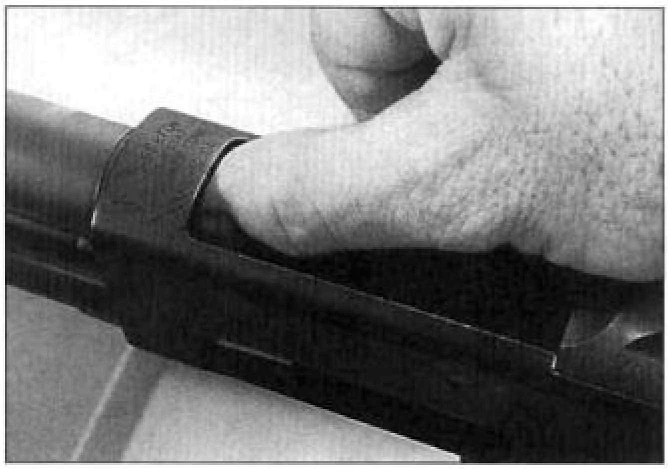
On pumps and autos, you will need a large screwdriver or socket wrench set to take the buttstock off. In order to feed the shells out of the magazine tube, pumps and autos have “shell stops” that feed one round at a time. (At least that's the plan.) On Remingtons these stops are staked into their slot in the receiver. To tighten existing stops or replace broken one you will have to re-stake. While you can build your own tool, it is inexpensive enough to simply buy one. In the sections concerning pumps and autos I'll show you how to check your shell stops. If you need them tightened, order the staking tool from Brownells.



A hidden shell can be very dangerous. If this shotgun had been brought in because the shell stops weren't working properly, a live round might still be in the magazine tube.

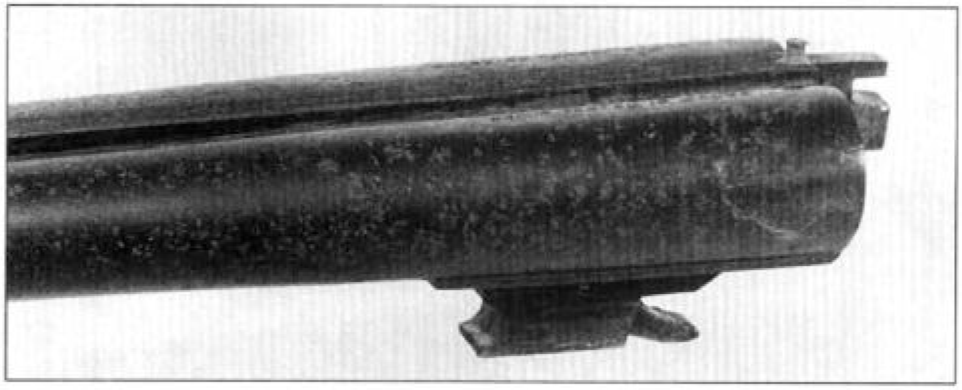
Cleaning the receiver takes brushes, solvent and lubricating oil. A parts cleaning tank is useful but not an absolute must. You can do as well in the laundry room sink with Brownells d'Solve, brushes and a heat gun or hair dryer to remove moisture.

You should have a dedicated bench on which to work, partly for comfort and partly for security. Cleaning your shotgun at the kitchen table may be a wonderful memory of your childhood, but is not likely to fly today. Besides being a mess, the solvents and lubricants you will use could harm the finish of cabinets and tables. Besides, they taste terrible. And a kitchen table is designed for comfortable eating, not comfortable working. Yes, the countertop is designed for comfortable working, but is even more likely to get you into domestic trouble than using the table will.



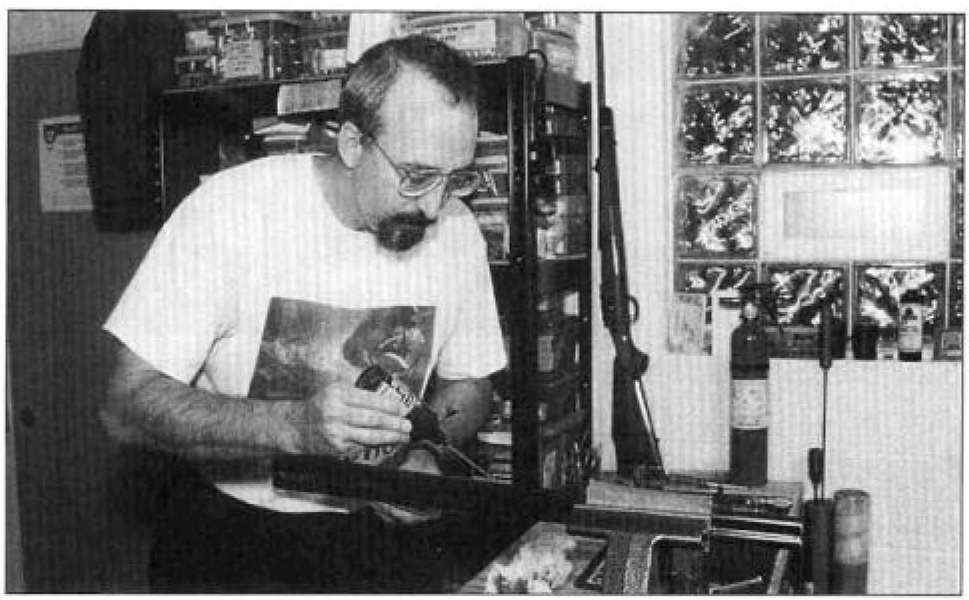
Do not trust that a shotgun is unloaded until you have checked personally. Stick a finger or thumb into both the chamber and magazine tube just to be sure. If you don't feel the follower on the magazine tube, it and a shell may be stuck farther up. Remember that electrical box I shot!

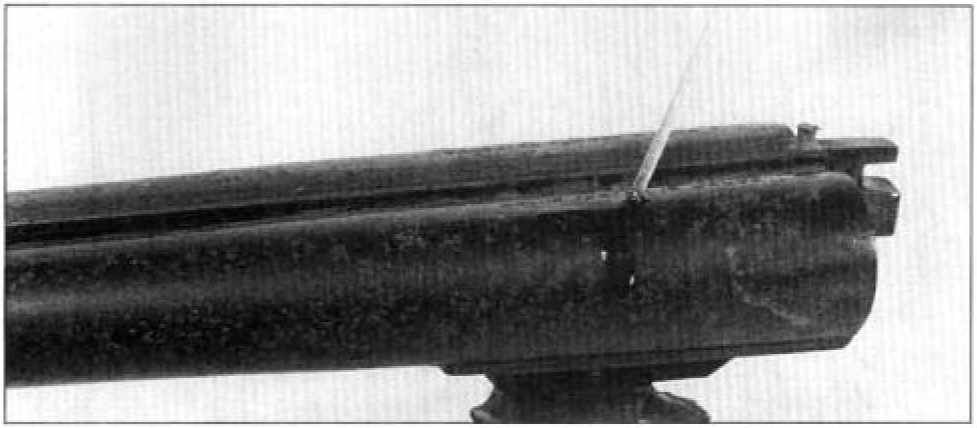
Your bench should be large enough to work on with the disassembled shotgun on the bench. It should have a vise large enough to clamp the shotgun in place. You must have padding for your vise. The jaws are designed to hold flat pieces of steel immobile. If you squeeze the receiver of a shotgun, you can bend or dent it enough to keep it from working. You'll need light to work by. A fluorescent fixture over the bench gives you a lot of light. As an addition, a desktop light with a flexible arm allows you to put a spot of light into the inner recesses of a receiver. For security, a bench with drawers or doors that can be locked will keep prying hands and mouths from your solvents and lubricants. You want to store your cleaning supplies separately from the shotguns themselves.



A common cleaning procedure is scrubbing spots of rust off a gun. Rust in and of itself is not an indication of neglect. I once spent a Sunday shooting in a match that featured 4 inches of rain. By the time I got home there was rust forming, even with an oiling after the day's shooting.

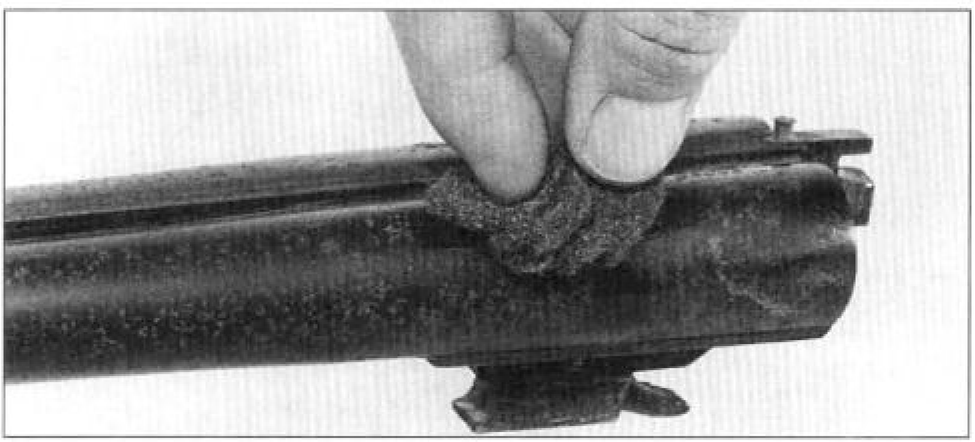
Hose some oil onto the rusted area.



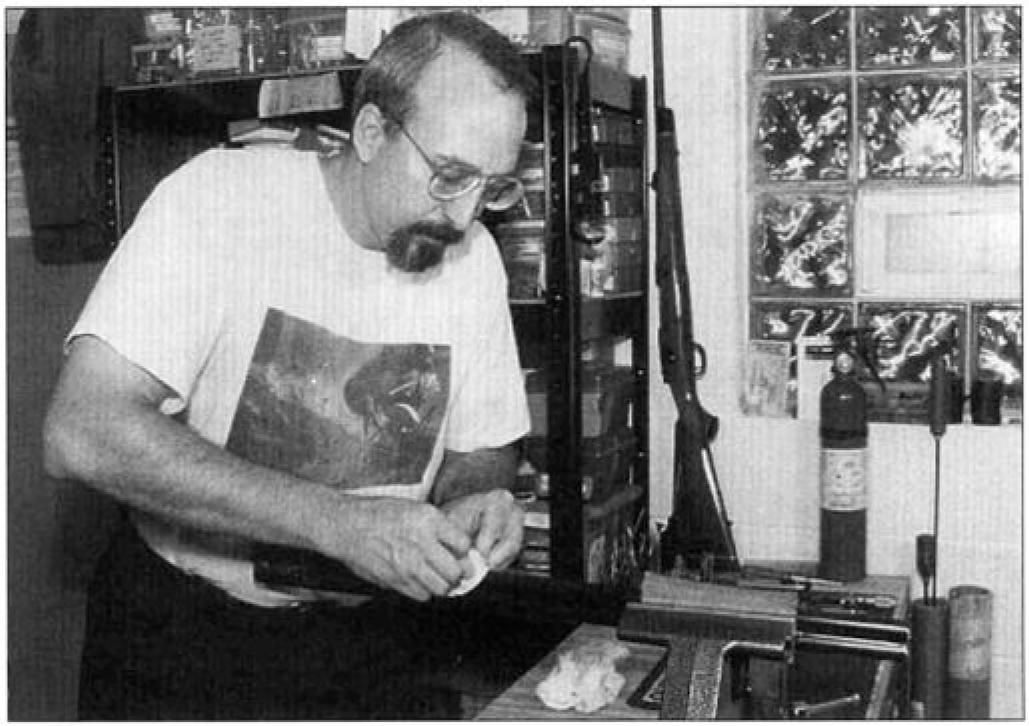


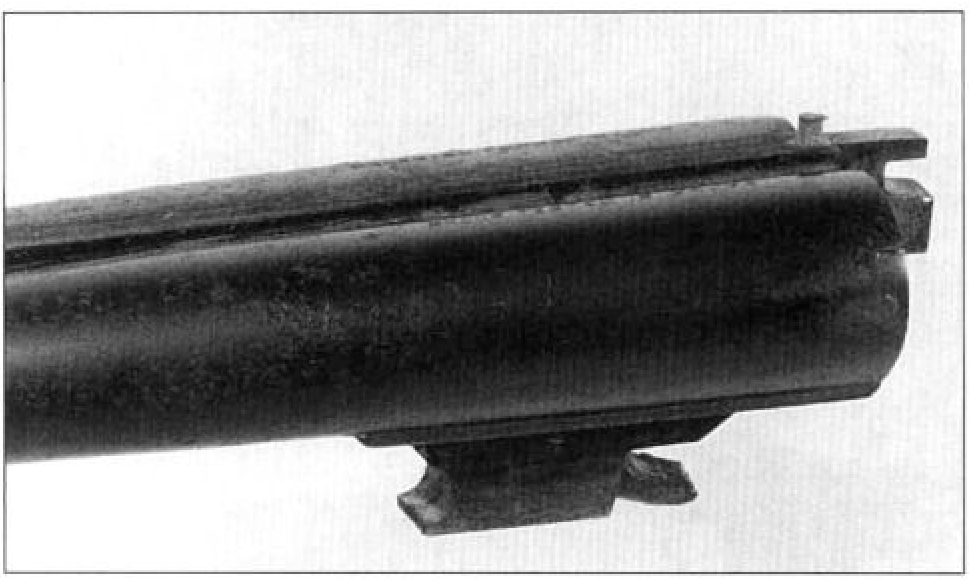
Don't be bashful, the oil provides protection for the steel from the particles of rust when you start scrubbing.

Use 0000 steel wool to scrub the rust. The lifted rust will float in the oil and not scratch the surface.



Once scrubbed, wipe with a paper towel.





The surface is now clean. Repeat over all affected areas.

This doable not only has a knarfed screw, but someone tried to remove the sideplate by prying its edge. The screw can be repaired, but the mar on the frame is forever.

If you are going to properly clean your shotgun, at home or at the range, you need a cleaning cradle.

A good sturdy bench with a cleaning that helps in keeping the parts collected.

Whether your shotgun is a century old, or was made yesterday, the cleaning methods remain the same.

Cleaning the shotgun bore, and maintaining the stocks are the same regardless of what type of action you have. Whether you are cleaning the bore of your Purdey after shooting some sporting clays, your Remington

1100 after an afternoon of bowling pin shooting, or your nephew's singleshot after saving the world from squirrels, the tools and methods are the same. Wood on a shotgun gets treated according to the finish it has, not the action it is attached to. First, I will cover bore cleaning, then the various action types, then wood maintenance.

Cleaning The Bore

Cleaning the bore is the easiest part of cleaning, it is the same for all shotguns, regardless of their action type. At first glance down many shotgun bores, you would think they were clean. After all, the bore is shiny, right? Too bad plastic and newly-burnished lead are shiny too. Bore cleaning involves the bore being in one of two conditions: either the bore was clean and you are simply cleaning as a precaution, or it has been fired. An example of the first case would be taking your clean shotgun out for hunting, and not firing a shot. Yes, the bore was clean, but while you had it out, moisture could condense in the bore, dust, leaves, twigs and insects could have landed there and lint from the gun case probably collected near the muzzle. To clean those out all you need is your cleaning rod and a swab or patches. Run a dry patch down the bore, followed by a patch damp with synthetic lubricant. Check the rest of the shotgun over to make sure you haven't dented or nicked it, wipe the steel with an oily cloth, the wood with a dry cloth, and put your shotgun away. Then, try to figure out why you didn't get any shots, and make corrections for your future hunting trips.

To clean or degrease, nothing is faster than the aerosol cleaners.

You need solvents and lubricants to clean. Always buy a bigger bottle than you think you'll need, there is no point in being cheap with cleaning solvents.

A sign of hard use and heavy loads, the gap between the barrels and standing breech of this shotgun are an indication its time has passed.

A fired shotgun is different. The bore will have plastic in it from the shot cup. Some lead-pellet loads with cheap wads will have lead streaks where

the shot flowed between the petals of the cup and contacted the bore. You had better hope your steel-shot shells don't feature cheap wads, because steel shot flowing between petals of the cup will score your bore. The plastic build-up will be heaviest at the forcing cone and choke, where the stresses on the wad are greatest. Your action may have powder residue and unburned powder in it, but action cleaning will be covered later with each type of shotgun.

Check to make sure the shotgun isn't loaded. Remove the barrel or barrels from the receiver. (Skip ahead to find your action type, or consult the owner's manual.) Clamp the barrel in your padded vise. With your cleaning rod, run a dry patch down the bore to wipe out the loose gunk. With a brush on your rod, brush the bore, and then swab with the dry patch again. Take a clean patch and place some cleaning solvent on it, and swab the patch through your bore several times. Clean the bore brush. Brush the bore and swab it with a dry patch. Repeal this process until the dry patches come out clean.

This is the traditional process, and it works. But it is a bit time-consuming. For some reason I have always been drawn to the high-volume shooting sports. While a skeet or trap shooter may go through 25 shells in 20 minutes shooting clay pigeons, a bowling pin shooter or practical shooting competitor could go through that many in five minutes. And then do it again 10 minutes later. My practice routine for bowling pin shooting takes 96 rounds and just under half an hour. With that kind of shooting, bores get packed with lead and plastic. No one wants to spend more time cleaning than shooting, so I worked out a few tricks to speed things up.

***A plain old copper scrubby such as this one is perfect for cleaning your bore*.**

First, get a bore swab. The kind that looks like a fuzzy caterpillar on a stick. Go to the grocery store and buy a copper scouring pad for cleaning pots and pans. The pad should be one of the copper mesh type. Cut the pad apart so you have strips of copper mesh that are at least six inches long and as wide as your swab is long. Wrap a strip around your swab. To clean, forget the first dry patch and run a patch damp with cleaning solvent down the bore. Take your copper-wrapped swab and use it as a bore brush. You may have to compress the swab and wrap the mesh tightly in order to get it to fit into the bore. Stan the swab from the chamber end. Scrub back and forth, paying particular attention to the forcing cone and the bore a couple of inches in front of the forcing cone. Plastic builds up in the forcing cone as the wad first slams into the bore, exiting the shell. As for the ring in front of the forcing cone, I can only figure that it is the location in the bore where the heat, friction and pressure are at their maximum. Either that, or it is the location where some sort of rebound of the wad happens after its first compression by the forcing cone.

Pull the swab out and swab your bore with a dry patch. The patch will come out a disgusting black mess. That's a good sign. The swab will probably have strips of plastic and chunks of lead in it. Unwrap the mess. Clean the swab and mesh. Re-wrap the swab, wet-patch the bore again and

then re-scrub with the mesh/swab. Two or three applications of this method and your bore will be clean. If you want to, you can do it to a bore you think is already clean, and see how much stuff you pull out. To clean the choke, take the cleaning rod without the last segment and handle on it. Install your swab/mesh cleaner and start the handle end of the rod through the chamber. Pull the rod through the bore until the scrubber reaches the choke. If you try to swab the scrubber back and forth it will expand as it passes out of the muzzle. You won't be able to force it back in. Instead, rotate the rod. If you have screw-in chokes, turn the rod in the direction that will tighten the choke. Once you have turned the scrubber three or four rotations, pull it out and run your dry patch through. Inspect the choke and if there is any more lead or plastic left, scrub again.

The copper mesh is softer than the steel of your barrel, so you can't harm the bore with it. As a bonus, it also works on rifled shotgun barrels, cleaning lead and plastic out of the grooves of the rifling.

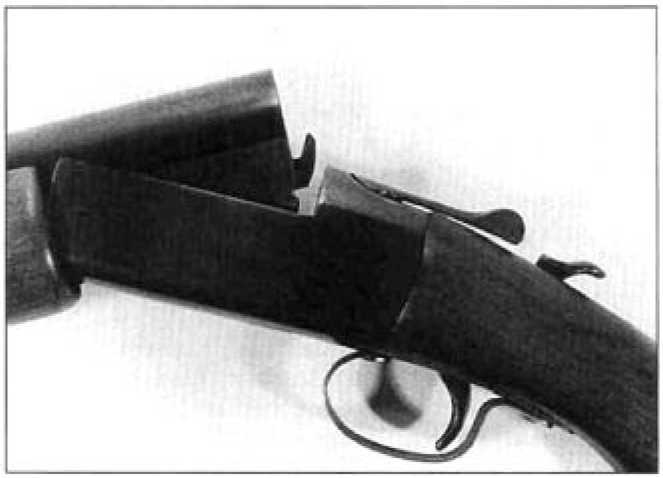
For the chamber, choke up on the cleaning rod and hold it 6 or 8 inches from the swab. Insert from the chamber end, and press the swab against the sides of the chamber as you scrub back and forth. If you try to clean a chamber this way with a regular brush you'll destroy the brush in short order. The swab doesn't care, and you will quickly scrub the plastic and powder residue out of your chamber.

With the rod, brushes and patches handy, you can scrub a bore sparkling clean in a few minutes.

Single-Shots

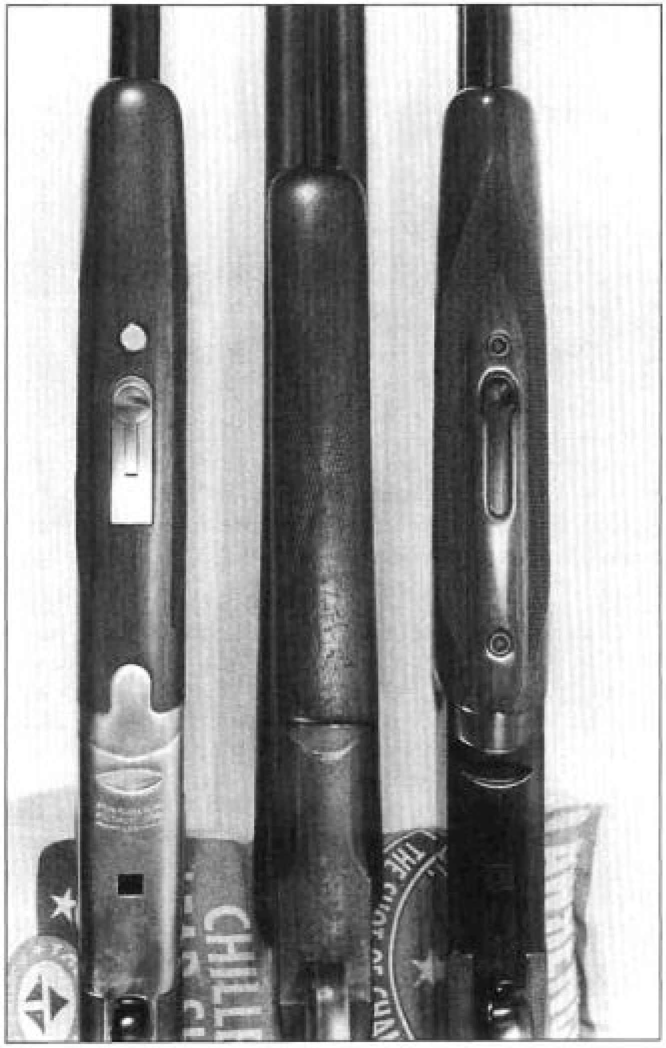
The single-shot is an easy shotgun to maintain. While some will have exposed hammers and others internal ones, they will all have a lever or something to open the action. Single-shots open by pressing the lever and allowing the action to pivot open on its hinge. The single-shot exists for safety and economy. A single-shot shotgun that is broken open cannot fire. It can easily be unloaded. Those with an external hammer cannot be fired until after the hammer is cocked. With a single barrel to fit, the shotgun does not require the elaborate regulating that a double does. By slightly bending the barrel, the manufacturer (or gunsmith) can move the pattern center up or down, left or right. The low cost to manufacture a single makes it attractive to shooters and hunters wanting a starter gun for a new shooter or hunter.

Open the shotgun to make sure it isn't loaded. Close the action and remove the forearm. On some inexpensive singles, the forearm is held in place by a screw that attaches to the stud under the barrel. On others, the forearm has to be pried down from the barrel. Look for a single screw, If present, remove it. If there is no screw, or two, pry the forearm down with your fingertips. Expensive singles may have a small lever inlet into the forearm that unlatches it from the barrel.



***Here is a typical example of a single-shot shotgun*.**

***A single-shot shotgun has only one barrel, and usually hinges open to expose the chamber*.**



On singles and double, the forearm protects you from the mechanism and vice versa. The dismounting method is not always apparent.

With the forearm off, open the action and the barrel will hinge down far enough that you can lift it out of the receiver. Scrub the bore. A basic cleaning of the receiver does not require removal of the buttstock. Scrub the breechface, water table (the flat or curved area of the receiver where the chamber rests) and the hingepin. If you use a water-based cleaning solvent, use a heat gun or blow dryer to evaporate the water. One advantage to the single- and double-barreled shotgun is that the receiver is well-sealed against the elements. Unless you are out in the rain, or take a spill into the water, there will be no need to get inside the receiver. If you have, the easiest way to clean singles is to remove the receiver from the stock and

dunk it in solvent. Most inexpensive singles (which is most singles) have their buttstock attached to the receiver by a throughbolt. Remove the buttplate. In a hole bored through the stock you will see a bolt. The bolt is either a slot-head or hex-head. If it is a slot, use a long screwdriver with a heavy shaft to loosen and remove it. If it is a hex-head, you'll need an extension rod for your wrench.

With the stock off, immerse the receiver in cleaning solvent and let it soak for an hour. Again, scrub and blow dry. Wipe the exterior with an oily cloth. Spray lubricant into the receiver and let it drip out onto a paper towel. Use a high-pressure grease on the hinge pin. Reassemble.

The fastest way to reload a firearm is to grab another loaded one. Faster still is to have another loaded one attached to the first one. When every shotgun was a single-shot shotgun, the fastest way to get a second shot was to have a second barrel. Popular today, the double is deceptively difficult to manufacture, even as it is so easy to use.

Double-Barrels

The double shotgun follows the same pattern as the single, with a lever to open and a hinge pin that lets it pivot open. For most of this century, doubles have had internal hammers. Necessary when shotguns were flintlocks or percussion muzzleloaders, and popular as a safety device when shotguns were cartridge breechloaders, the external hammer faded from use when the double shotgun was passed over as a fighting tool. When internal hammers and their safeties become completely reliable, the external hammer had no advantage. However, with the increase in popularity of Cowboy Action shooting, external-hammer doubles have made a comeback.

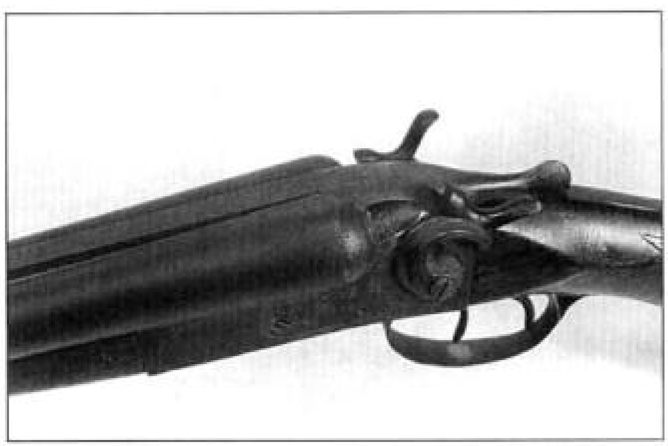
The standing breech is the face where the firing pin holes are. The water table is the flat section in front of the breech.

Press the lever and open the shotgun. Make sure it isn't loaded. Close it. Look underneath the forearm. You'll find an inlet bar on the centerline. If the bar has a little lever in it, then press the lever and remove the forearm. If the bar does not, it is the anchor for the spring lock. If you see screw heads but no lever, leave them alone. Work your fingertips between the tip of the forearm and the barrel, and pry the forearm down off the barrel. Open the action and hinge the barrels forward off the action. Scrub the bores.

The top lever opens singles and doubles. (And the much rarer drilling, the triple.)

The action should be brushed clean, the breechface and walertables wiped with an oily cloth, and the hinge pin greased. Like singles, the double is well-sealed. Unlike singles, quite a few doubles have a complicated disassembly routine. In the most complex, the receiver is a sandwich of breechblock and upper tang, with the safety button on the upper tang. The lower tang is a plate that contains the triggers. Some doubles will have fake sidelocks, plates on the sides that look like they are the locks, but are only cosmetic. Unless you know the sequence of screws to remove, you could be loosening something that is supposed to stay tight. And getting it back together with the safety linkage properly engaging the button and bearing against the triggers, can be a frustrating struggle.

I'm not saying you shouldn't take it apart, but you should do so only with written instructions. If your shotgun doesn't have an owners manual, take it to a gunsmith who can properly disassemble it. Explain right up front that you are not looking for a “strip and clean,” but instructions. He will probably charge you as much or a little more to teach as he would to simply clean. Pay attention and take notes.

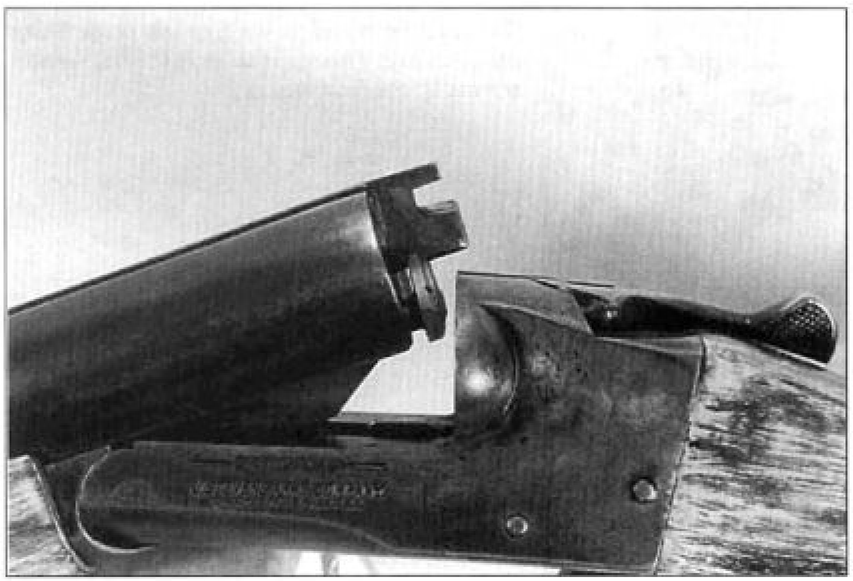


Hammer guns stayed around so long at the end of the 19th century because you could easily see if it was loaded or cocked. Even if it was loaded, if the hammers weren't cocked, the barrels couldn't be fired.

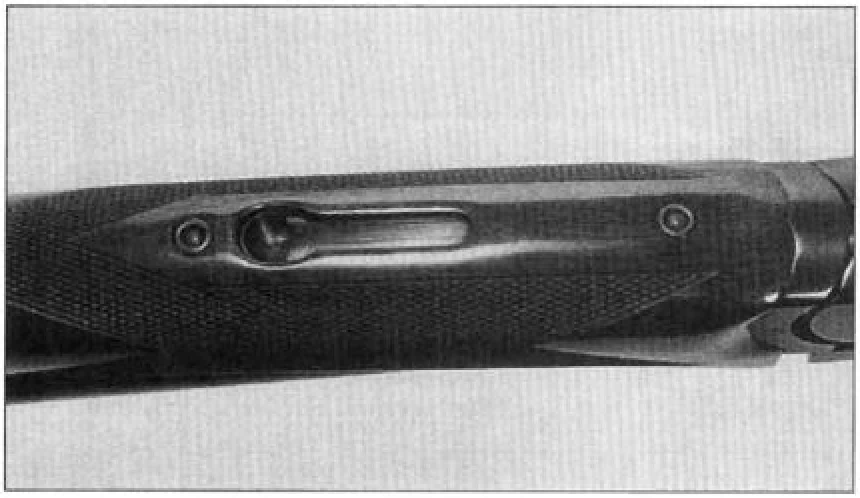
The shotguns that will be a bear to take apart will be the imported doubles from Spain and England. Because of the difficulty in disassembly of the

“sandwich” design, manufacturers have made doubles that have the stock held on with a single throughbolt.

The most common double that uses a stock bolt is the Savage 311. In many parts of the country, when you say “double” everyone will take that to mean “311.” While somewhat heavy and not particularly sleek, the 311 has the advantage of being tougher than a two-dollar steak, I have never seen a 311 broken except through utter neglect, or deliberate abuse or experimentation. All doubles that use a stock bolt must be disassembled by first removing the bolt and stock. To find out if yours is such a double, remove the recoil pad or buttplate and look. If there is a large diameter hole and a bolt or screw head at the bottom, there is your answer.

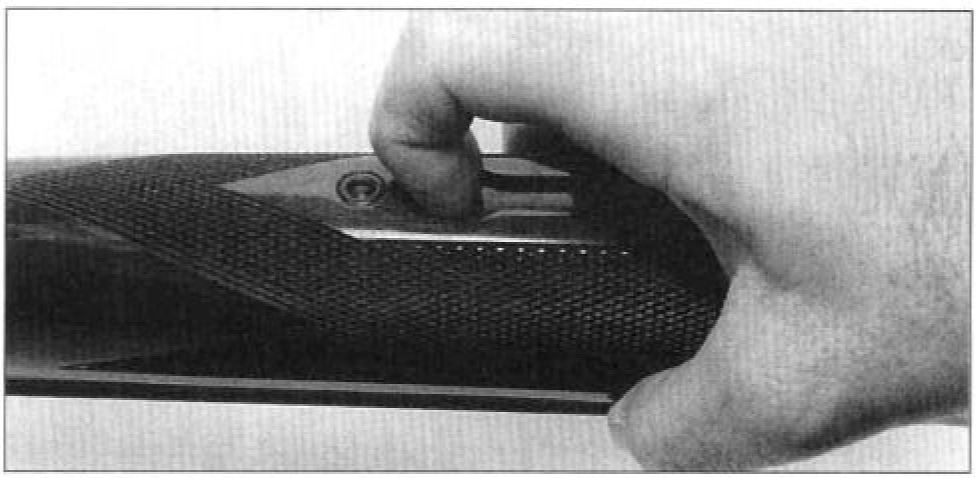


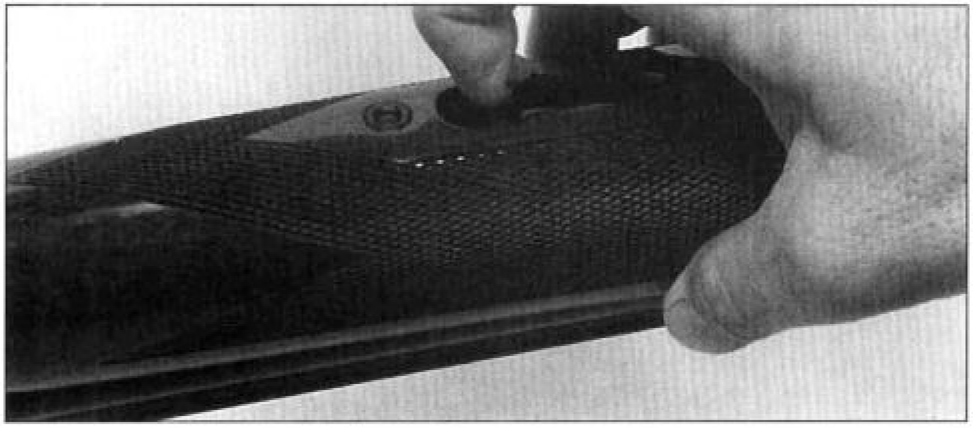
This is a double, showing one method of locking reinforcement, the center extension.



This view shows the disassembly latch on a Weatherby forearm.

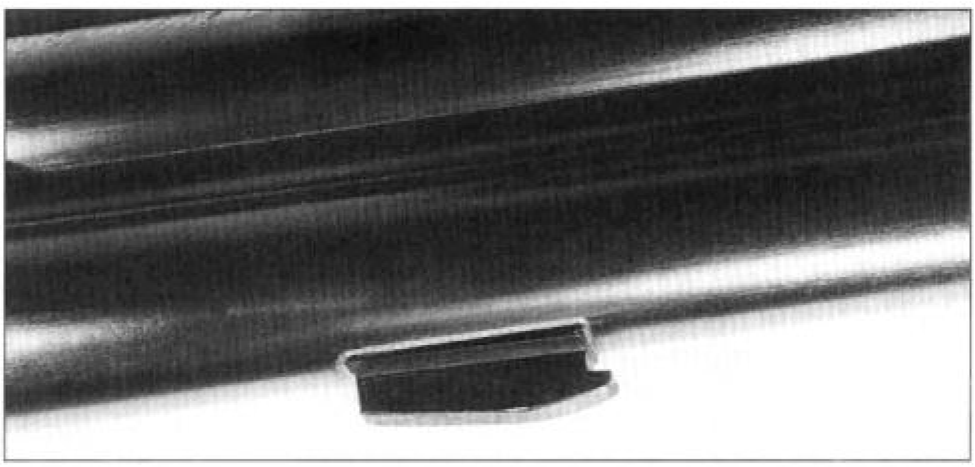
Lift the latch with a fingertip…

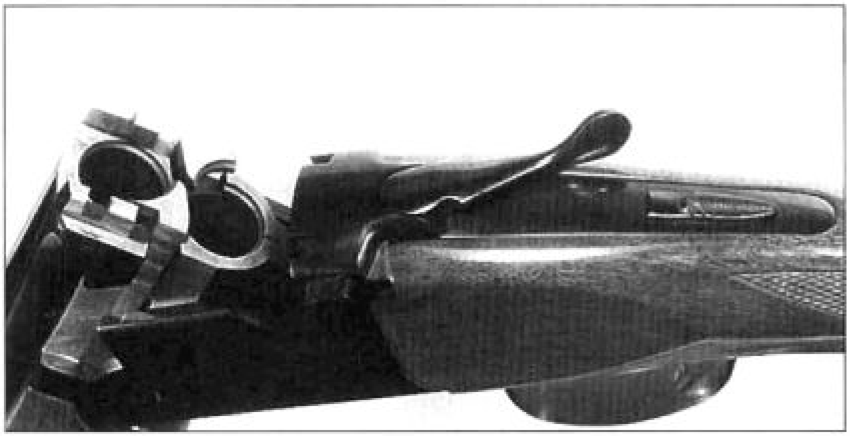




…and lift the lever and pivot the forearm away from the barrels.

The forward lump on the bottom barrel secures the forearm.

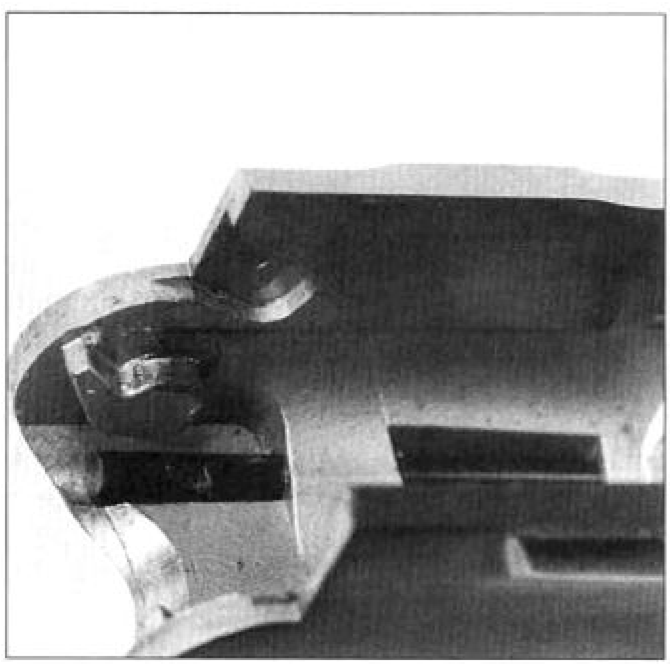




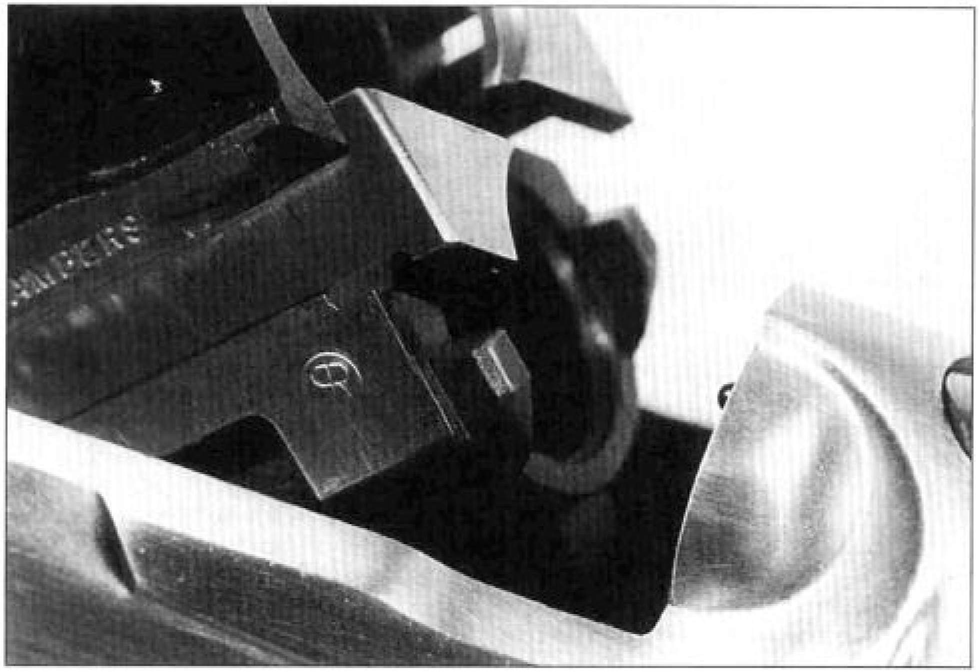
This is a photo of a Weatherby Orion, showing the over/under design and the Merkel locking lugs on either side of the upper barrel.

A solidly-made shotgun that is given good maintenance will outlast the best of us.

It is easy to see how to remove the firing pins in this gun. All you have to do is grind a special screwdriver to span the pin and engage the nut.



Oil the cocking rod (the dark bar) and put high-pressure grease on the barrel pivot, the hooked knob on the side.



The Ruger, with its lower locking lugs.

One suggestion about scrubbing these receivers; there may be delicate parts or small springs in there. When you first pull the stock off, look carefully at the location of the springs and parts. It is a good idea to make a drawing of the proper orientation of the parts. One early trick I learned was that if a shotgun had been disassembled, or parts had fallen off, the easiest way to determine where the parts went was to compare the one I was working on with an operating example. (This also the reason gunsmiths end up with a couple of hundred guns as a “personal” battery.) You don't have the luxury of owning two of each of your shotguns just to have a working sample with which to compare. Make drawings that are clear to you.

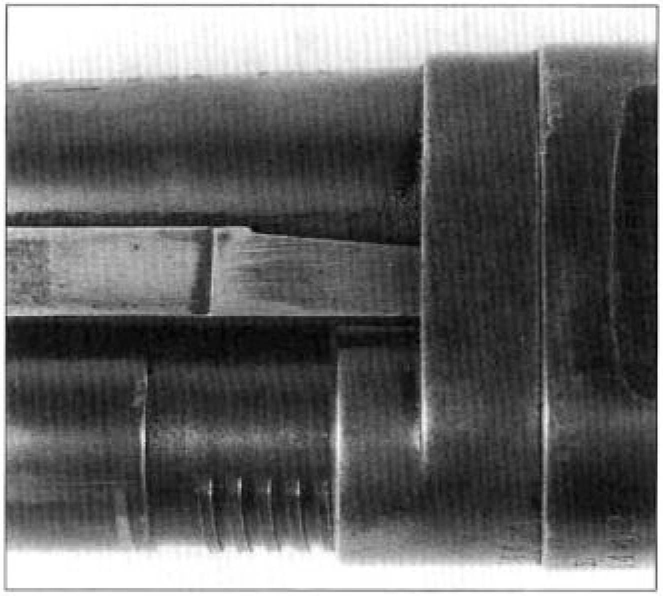
Once you have scrubbed the insides clean and dried them, you have to lubricate them. It may be years until you open that particular shotgun again, and all of the surfaces have to be protected. Oil or other lubricants only

protect where they coat. Give the internals a complete coating of all parts, and let the receiver drip out onto a paper towel for a few hours or overnight. The gunsmith who taught me, Dan McDonald, said “Oil is cheap and rust is expensive. Coat the surfaces and let it drip,” Once the excess has dripped off, then reinstall the stock.

As with the single-shot, use a high-pressure grease to coat the hingepin. Ail side-by-side doubles, and some over-unders use a pin that passes through the receiver from side to side. Some over-unders (the Browning Superposed is an early example) use a pair of trunnions on the sides of the interior of the front of the receiver. Circular hollows on the sides of the barrel assembly ride over these trunnions. Grease both sides.

Pumps

The first pump shotgun to be seen in any quantities was the Spencer. It established the pattern for pump shotguns to come, being a hammerless model with a tubular magazine under the barrel and a front slide to work the action. The design was complicated and required intricate machining, making it more expensive than contemporary doubles. Economic difficulties put Spencer out of business and the remaining parts were marketed by Bannerman. An odd design, but one that enabled the shooter to clean the bore from the chamber, was the Burgess. Built just about when the Winchester design by Browning was coming onto the market, the Burgess differed from other pumps (and the 1897) in two ways: The pump to operate the mechanism was not up front, and it didn't come apart into two pieces. Taking a pump apart for storage and transport was considered an important part of its marketing. Shooters and hunters a century ago traveled to the range or the hunting grounds by horse, buggy, streetcar or bicycle. Even in the 1930s my father, who lived in the city, could take a streetcar to the edge of town to practice or hunt. The contemporary doubles came apart into a compact package. A pump that did not was at a disadvantage in the sales arena.

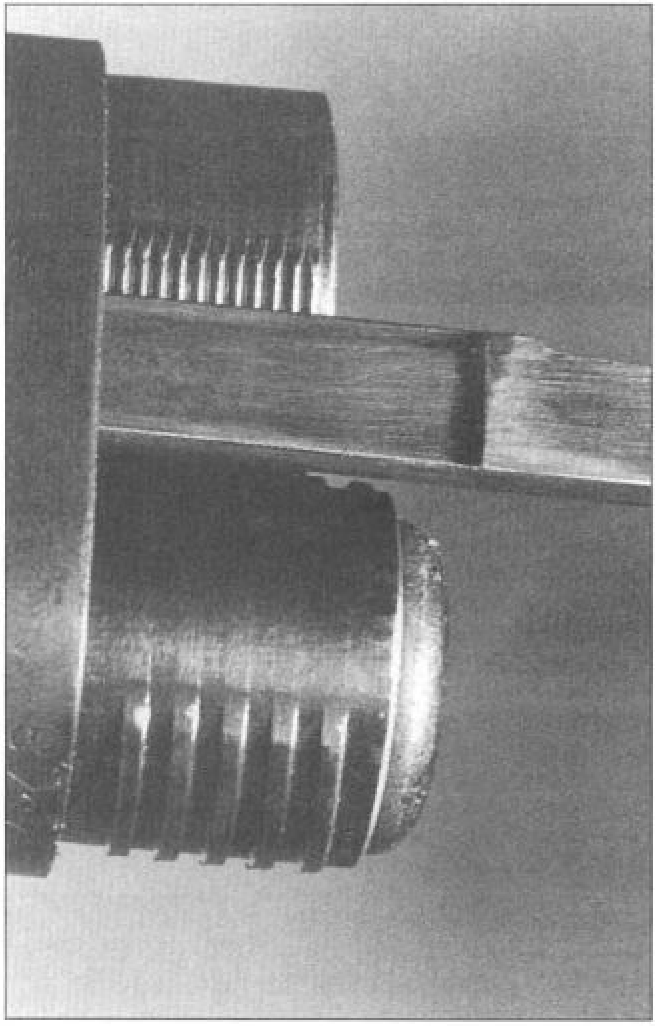


***Early pump shotguns came apart right at the front of the receiver*.**

The operating handle of the Burgess was a sliding part of the pistol grip. It and the trigger moved back and forward to cycle the action. It seems odd now, but back then there was no established “right” way to work the action, and the grip hand was just as good as the front hand. The Burgess opened for cleaning and storage by a latch. Opening the latch hinged the barrel and magazine tube down, but they stayed attached. One very interesting feature of the Burgess was that it could be folded for storage while the magazine was loaded. By snapping it shut and working the slide, the shotgun was ready for action. The competing Winchester could not be stored loaded. As a ready weapon for bank guards, messengers and railroad guards, the Burgess had much going for it.

The Burgess company had a serious competitor in Winchester. By 1897, Winchester had the now-famous Model '97 on sale, and a take-down model was soon to come. His health failing, Andrew Burgess sold the patents and machinery to Winchester.

The takedown shotgun a century ago came apart in two pieces, the receiver and stock, and the barrel and magazine. It was strong, but expensive. To have a two-barrel set for your shotgun involved the cost of a magazine assembly, and fitting the extra assembly to the original receiver.



The front half was a package that required each replacement barrel have its own magazine tube. The result was expensive and heavy.

Not all shotguns back then came apart this way, but the story of the Browning A-5 is for later in the book.

The first pump shotgun that came apart by removing only the barrel was the Remington Model 17, designed by (drum roll, please) John Browning. The barrel used interrupted threads, and a knurled nut on the end of the magazine tube locked the barrel extension in place. Making replacement barrels for the Model 17 was easier and cheaper than the Winchester method, and replacement barrels did not require fitting. A shooter could have different barrels for competition, hunting and defense. If you ever run into a Remington Model 17, it will look oddly familiar. By 1933 Remington

had dropped the M-17, as they had newer designs to sell. The Browning patents were soon to run out, so Ithaca stepped in. At the time Ithaca was a maker of double guns. But Ithaca redesigned the Model 17 action slightly, enlarged it to 12-gauge (the Remington M-17 had been a 20-gauge only) and have since then endeared themselves to left-handed shooters.

The economic advantages to barrel-only removal made the design the dominant one in the market. While not as compact when disassembled, the cost savings are worth the size difference.

The general instructions for disassembly are simple. Make sure it isn't loaded. Open the action and leave it open. To take your pump shotgun apart you will have to turn a nut on the end of the magazine tube. If it has been on for a long time, or was tightened down by a strong person, you may need assistance. Do not seek that assistance in the form of pliers. You will scar the magazine nut. Open your Brownells catalog and order their padded and curved shotgun disassembly pliers. With these you can take your shotgun apart for the rest of your life without marring it. With the nut loosened or removed, slide the barrel off.

On pumps using crosspins, press the pins out and slide the trigger assembly out of the bottom. On pumps using screws, you'll need properly fitting screwdrivers. With the barrel off and trigger assembly out, slide the forend forward. Depress the shell stops to slide the forearm and bolt out of the receiver. Specific instructions to follow.

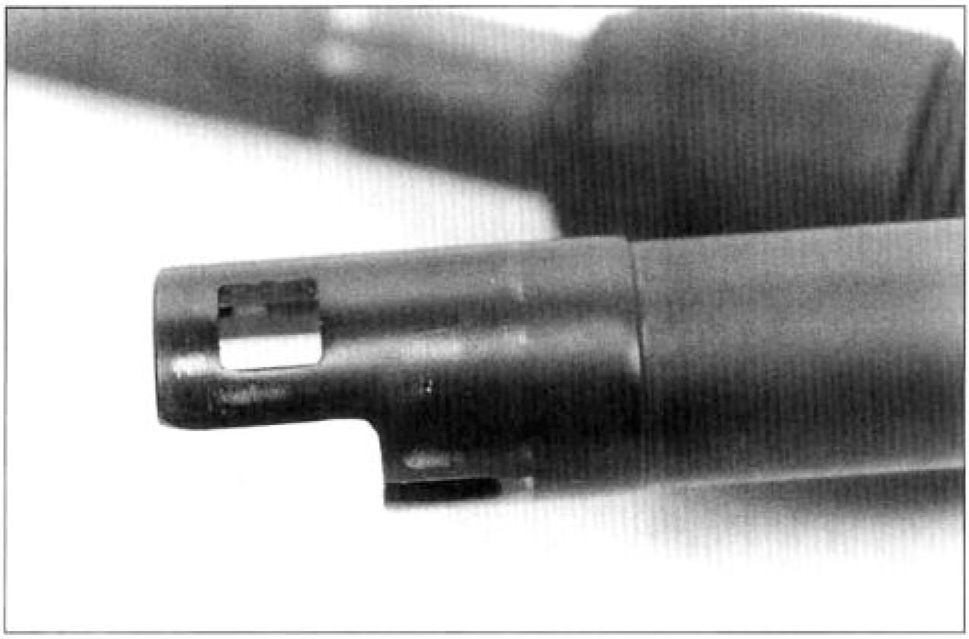
To clean, scrub the interior of the receiver, bolt, trigger assembly and forearm rails. Dry and lubricate them. Reassemble.

The Remington 870

The 870 has been around since 1950. Unlike the earlier Remington Model 31, the barrel retainer is not a lug, but a ring that surrounds the magazine tube. The ring has made the 870 popular with law enforcement agencies, because by replacing the magazine nut with a tube, you can increase the capacity of the shotgun.

To strip and clean the Remington, make sure it is unloaded, the hammer is cocked, and the action is open. Unscrew the magazine nut. Slide the barrel forward off the magazine. With the drift punch, press the two trigger pins out of the receiver. Pivot the trigger assembly down out of the receiver. On the Remington 870 the shell lifter is attached to and spring-powered by the trigger assembly. Inside the receiver you will see two flat pieces of spring

steel on the sides. These are the shell stops. When you gently ease the slide forward, the stops will keep the slide from coming out. If you try to force the slide, the operating rods may loosen the shell stops. Loose shells stops usually mean an 870 that will not feed properly. With your fingertips press one and then the other down to let the slide pass. Once out of the receiver, the bolt and its carrier plate will fall off the operating rods.



The Remington 870 bolt locks into an extension of the barrel. The idea was not new to Remington in 1950, but rather came from John Browning and the A-5 in 1898.

Scrub the powder residue off the bolt, carrier, the inside of the receiver and the parts of the trigger assembly. Lubricate everything. Cleaning the magazine tube requires removing the spring retainer. On older 870s the magazine spring is kept in place by a spring steel cap that is press-fit into the magazine. With a screwdriver, pry the cap upwards until it is free. Pull the spring and follower out and clean them. To replace the cap, press the spring into the magazine with one hand while compressing the cap into it. Tap it flush with a mallet or screwdriver handle. Newer 870s use two detents in the tube, and a plastic retainer. The retainer has two sets of grooves in it. One set passes completely along the sides, while the other stops. To remove the retainer, use a screwdriver that fits in the slot on top of

the retainer. Press the retainer down and turn it one-quarter turn. Ease the retainer forward and it will slide out of the magazine. To replace it, line the full grooves up with the detents and press the retainer in. Give it a quarter turn and ease it forward.

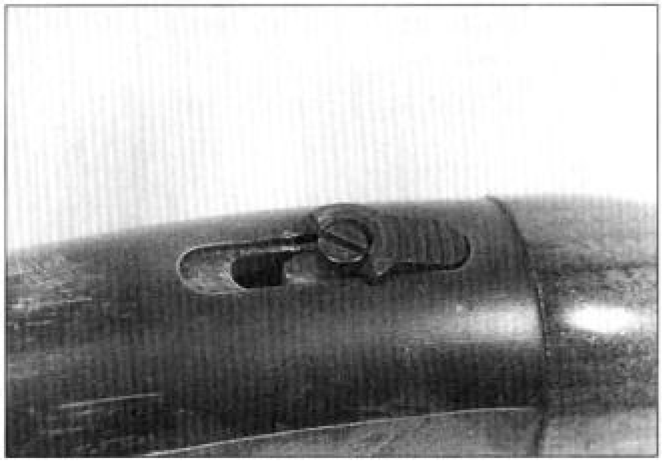
For the first step of reassembly you will need to juggle four parts, the bolt, carrier plate, forearm and receiver. The easiest way is as follows: Place the carrier flat on your bench within arm's reach, with the bolt in place on top of it. Stand the receiver upright on the bench or in your lap with the bottom to your left. With your right hand, start the slide over the magazine tube. Hold the slide in place, and keep the receiver upright, with your right hand. Pick the bolt and carrier up with your left and place them on the cutouts in the operating rods. Slide the forearm down until it starts into the receiver. Let go with your left hand and depress the shells stops in turn to let the rods go into the receiver. Once in place, put the barrel on and install the magazine cap. Installing the barrel right away is a precaution against running the slide forward and loosening the shell stops.

To replace the trigger assembly, tilt the trigger assembly slightly towards its angled lever. This is the slide lock lever. Ease the slide lock lever into the receiver, and then press the trigger assembly into place. Line the holes up and press the trigger pins through the receiver.

The Mossberg Model 500

The Mossberg has many design characteristics similar to the old High Standard pumps. High Standard went out of business in the early 1970s but many of their shotgun still serve faithfully.

The big advantage that Mossberg had over High Standard was its removable barrel (yes, High Standard was making shotguns thal did not have a removable barrel, even into the 1960s!).

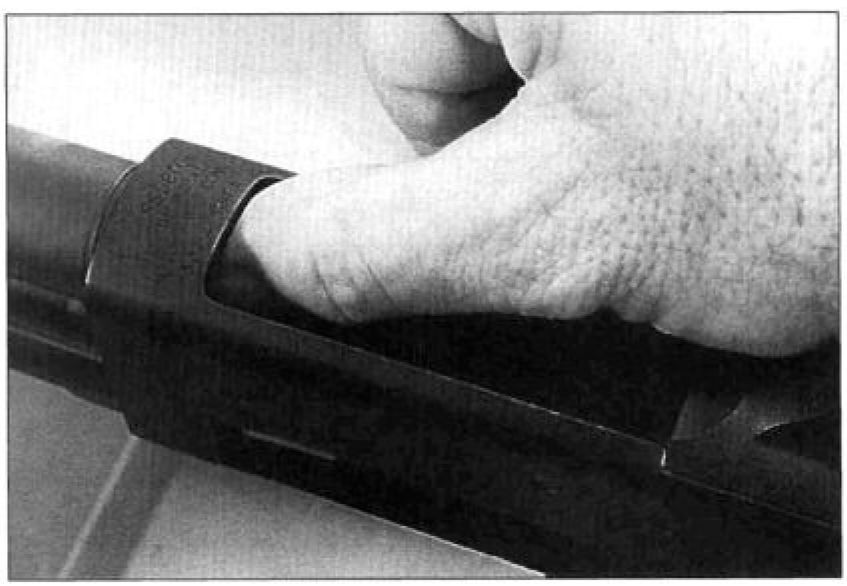


A broken safety on the Mossberg 500. On top, it can get in the way of obstacles and become cracked or broken. Replacement is easy.

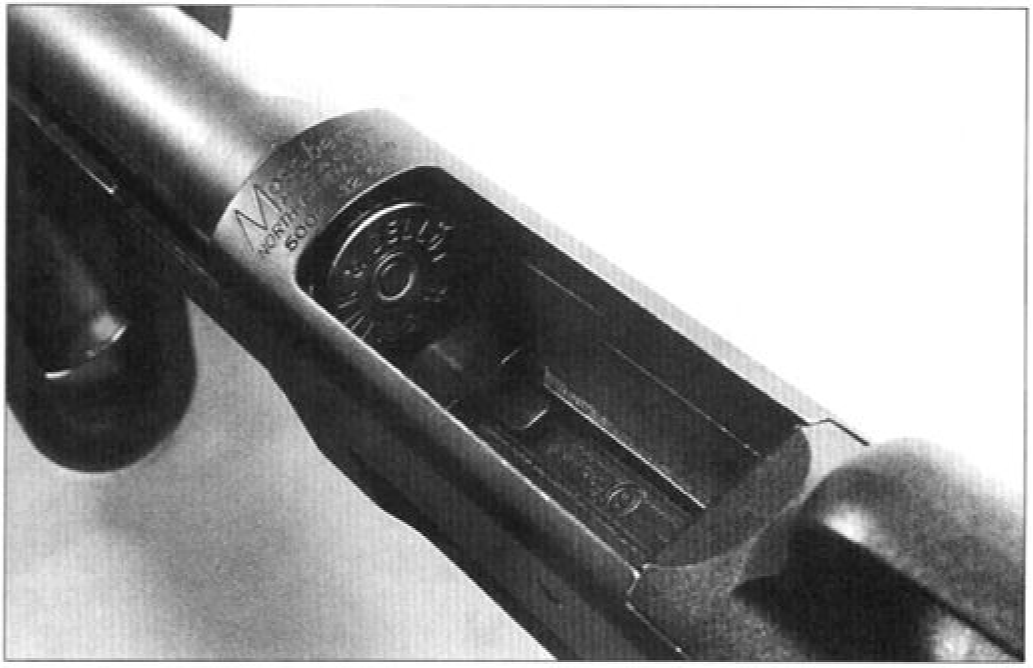
While desirable, the removable barrel is not the remarkable thing about the Mossberg design. It has four things that make it an exemplary shotgun; the safety, the shell stops, the receiver itself and the shell lifter. The safely is a button on the top center rear of the receiver. For decades the Mossberg was unique in this. While other shotguns had a button in the triggerguard that had to be replaced for left-handed shooters, the Mossberg didn't. The shell stops in the Mossberg design are not staked into the receiver. Staking the shell stops would be a spectacularly bad idea because the receiver is aluminum. Instead of being made from a steel forging, the Moss-berg's aluminum receiver is easier to machine, lighter and rust-free. The shell lifter rests tight against the bottom of the bolt carrier. It only drops down into the path of a shell from the magazine when it is needed. On other shotguns, you can “double feed” a shell. If, when you press the shell into the magazine, you do not press it far enough for the shell stops to catch it, the shell can pop back into the receiver. Trapped between the carrier and the lifter, the shell wedges the action tight. In a Mossberg, if you do not press the shell in far enough for the stops to catch it, it will drop back out on the ground. Yes, it is an annoyance to pick it up, but nothing like the headache of correcting a double feed.

The Mossberg lifter stays tight to the bolt when closed, and you cannot double-feed a Mossberg. If the shell is not caught by the shell stops, it gets flung to the ground.

When inserting a shell, push your finger or thumb into the tube. This ensures the shell is caught by the shell stops.



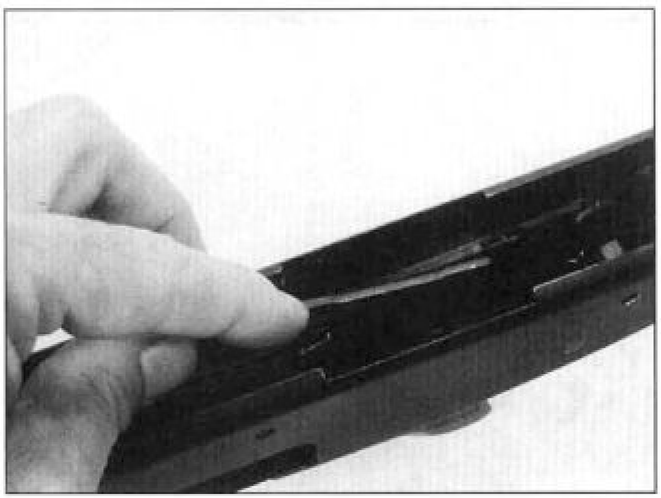
To disassemble the Mossberg, make sure it is unloaded. Open the action. Turn the knurled nut on the front of the barrel extension. The nut will stay on when the barrel it is removed. Once the nut is unscrewed, pull the barrel off. On the receiver there appear to be two pins. There is only one, and it is the smaller one farther back from the ejection port. Drift this pin out. The trigger mechanism is held in place at the front by two shelves that fit into recesses in the receiver. Pivot the rear of the trigger assembly down and out of the receiver. The shell stops will fall out on their own. Slide the forearm back until the rectangular plate under the bolt lines up with the wide slot cut through the bottomof the receiver. Lift the connector plate out, and push the bolt forward out of the receiver. The shell lifter is a tuning fork-like piece of spring steel. Unlike the 870 it is not attached to the trigger assembly, and is powered by the bolt. It pivots on two circular bosses that can be seen above the trigger assembly retaining pin, this is what appears to be another crosspin, but isn't. To remove the lifter, use a small screwdriver to pry the rear of the lifter out of the circular holes that have been drilled through the receiver. Scrub the parts. With all of its advantages, you have to figure the Mossberg has some drawback. One small one is the magazine tube. Because the barrel retaining nut screws into the end of the magazine tube, you can't remove the spring and follower that way. Instead you must unscrew the magazine tube. Clamp your receiver in a padded vise. If you are strong you can unscrew it by hand. Otherwise, use a strap wrench or a padded pair of curved pliers to unscrew the tube. To reassemble almost requires three hands. The follower stop shoulder is machined into the receiver, and as you attempt to screw the tube in the follower and spring will push back. Use your right hand (for right-handed 'smiths) to turn the tube, while with your left hand you press the follower back into the tube. Once you have the tube turned all the way into the receiver you can let go of the follower, and give the tube its final tightening turn. You needn't tighten it more than hand tight. Once the barrel is in place the magazine tube isn't going anywhere.



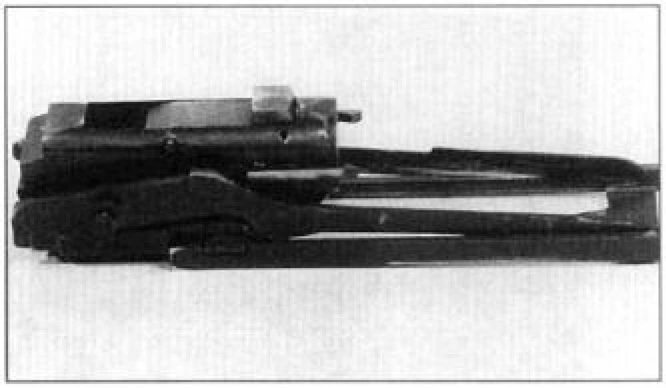
The simplicity and durability of the Mossberg 500 is obvious. No small, easily bent or broken parts, and nothing to keep you from seeing (or feeling) if there is a shell in the magazine.

What looks like a disassembly pin on the right side is the pivot rod for the right-hand shell stop.

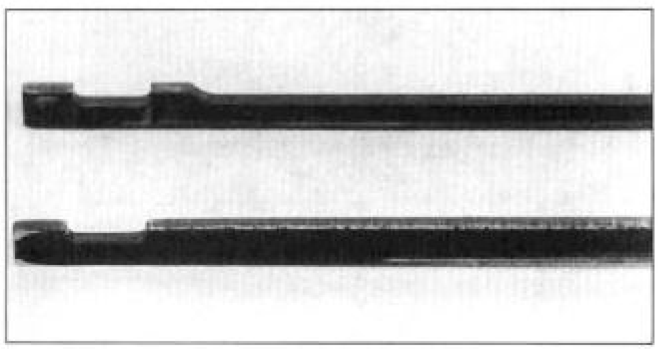
To reassemble the receiver, turn the lifter until the hooked end is towards the safety, and the points of the hooks are towards the bottom of the receiver. Squeeze the rear of the lifter enough to slide it into the receiver. Press it down until the two circular bosses snap into their holes. Push the bolt into the receiver, and push the forearm back until the bolt and action bars are positioned in the rectangular slot. Place the slide plate down on the bolt, and engaging the action bars. If you do not have it in place, the forearm won't go forward, or won't take the plate and bolt with it. Replace the barrel. Run the slide forward. Turn the receiver upside down on your bench or in a padded vise. Place the shell stops in their slots, with the tabs in the space between the operating rods and the receiver. Each stop is designed to fit only in its appropriate slot. Take the trigger assembly and catch the shelf on its front into the slots in the receiver. Pivot the rear into the receiver and press the crosspin through.



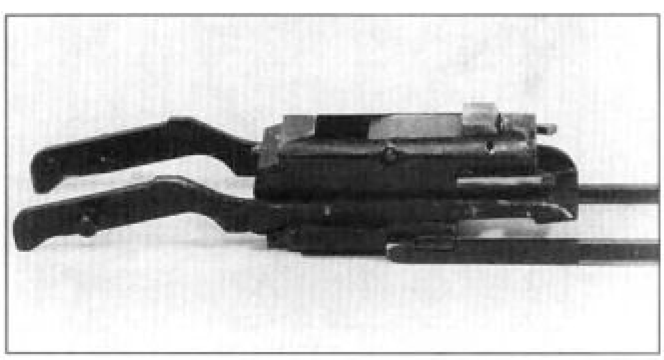
***The Mossberg shell stop are not staked in place, and do not have to be timed if replaced*.**



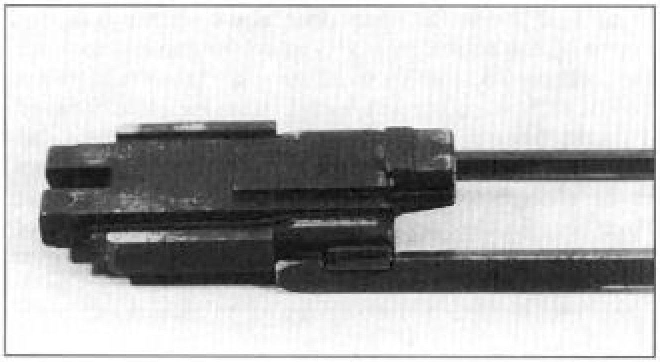
When the bolt is back, the rear legs of the lifter cam against the bolt slide and the front is forced down.



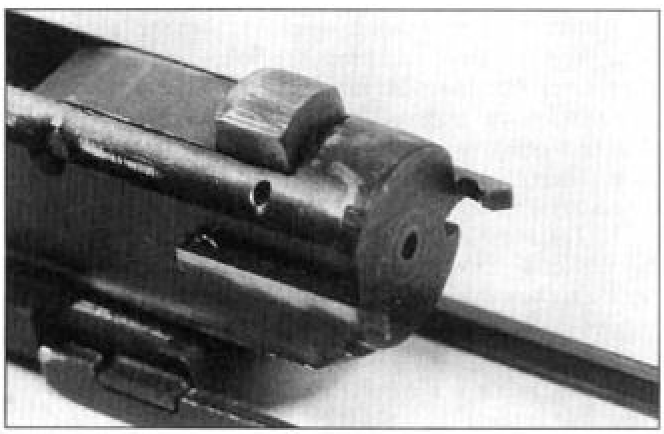
The action rails are simple steel bars.



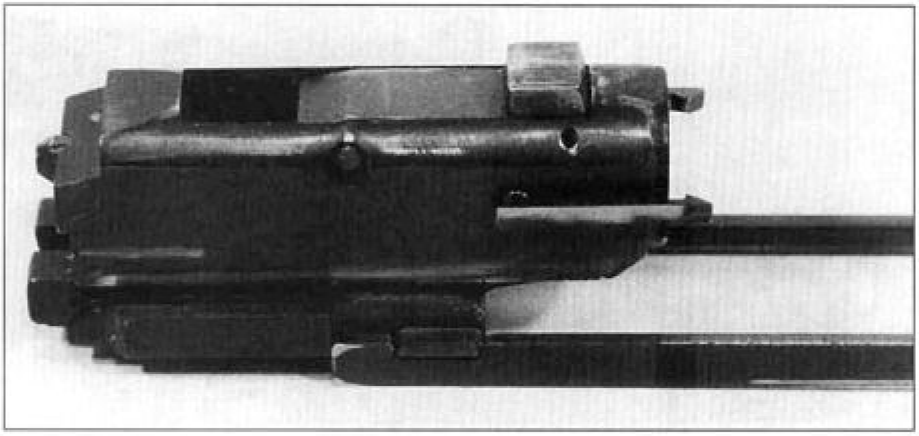
When the bolt goes forward, the lifter is cammed up, raising a shell into the bolt's path, and clearing the magazine tube for further loading



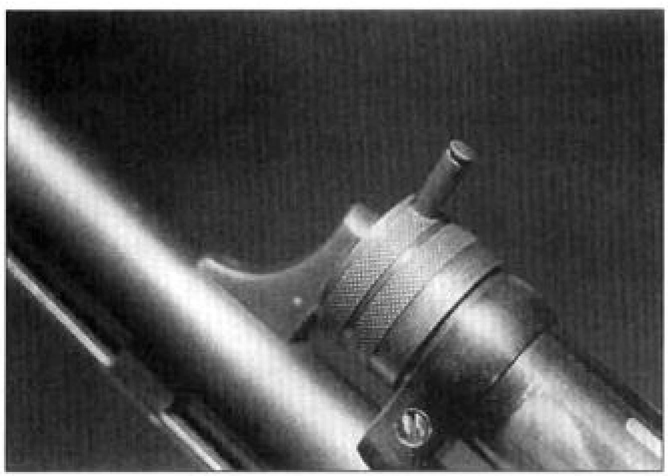
The bolt slide rests in the action bars.



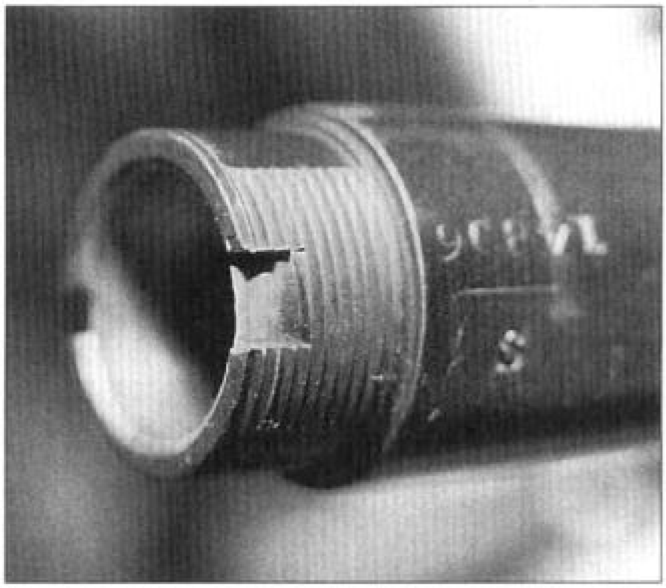
The Mossberg features dual extractors, ensuring a firm grip on the fired hull.



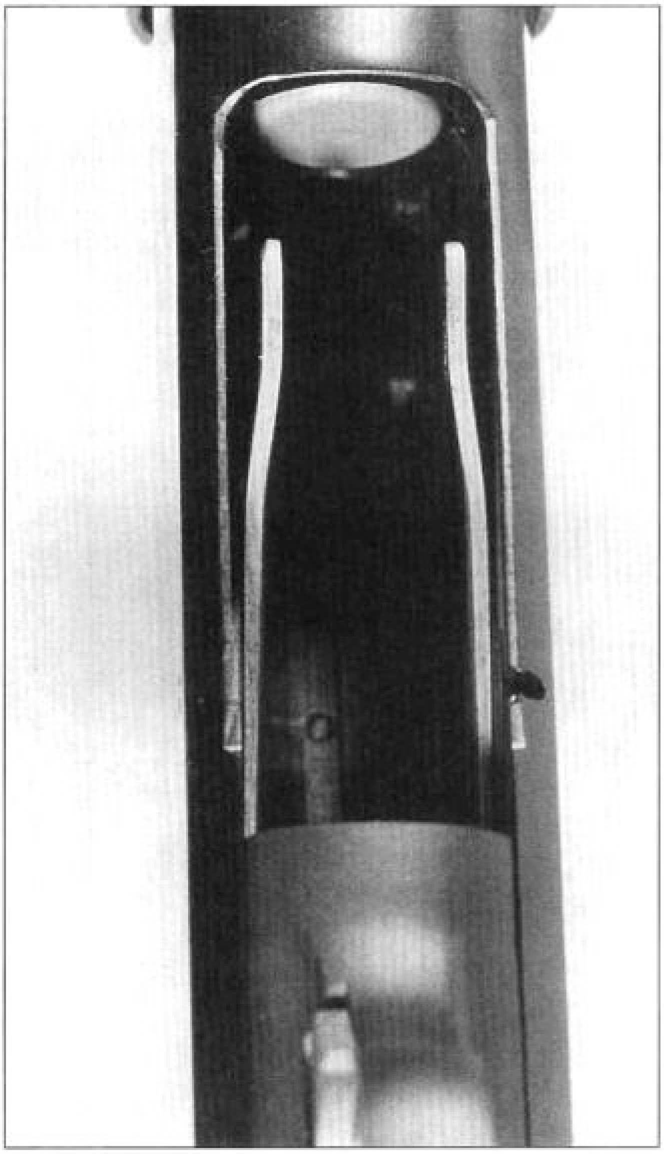
The bolt rests on the bolt slide.



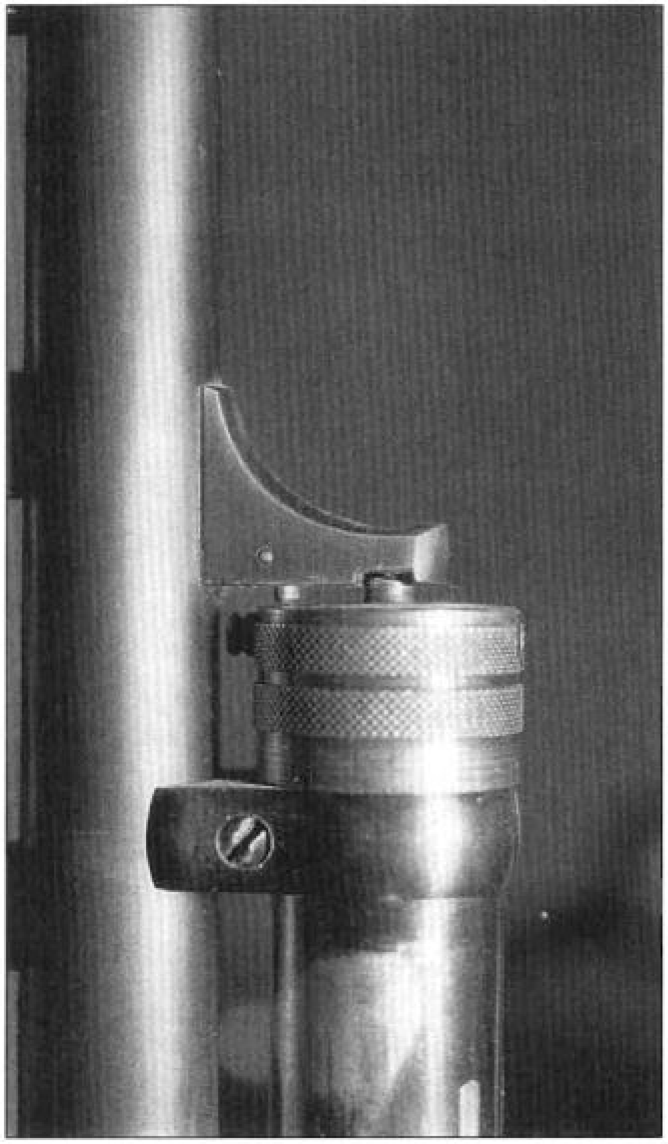
The Ithaca barrel is secured with a barrel extension that engages the magazine cap.



The Ithaca barrel is slotted for the extractors, and you must have the action open the remove the barrel.

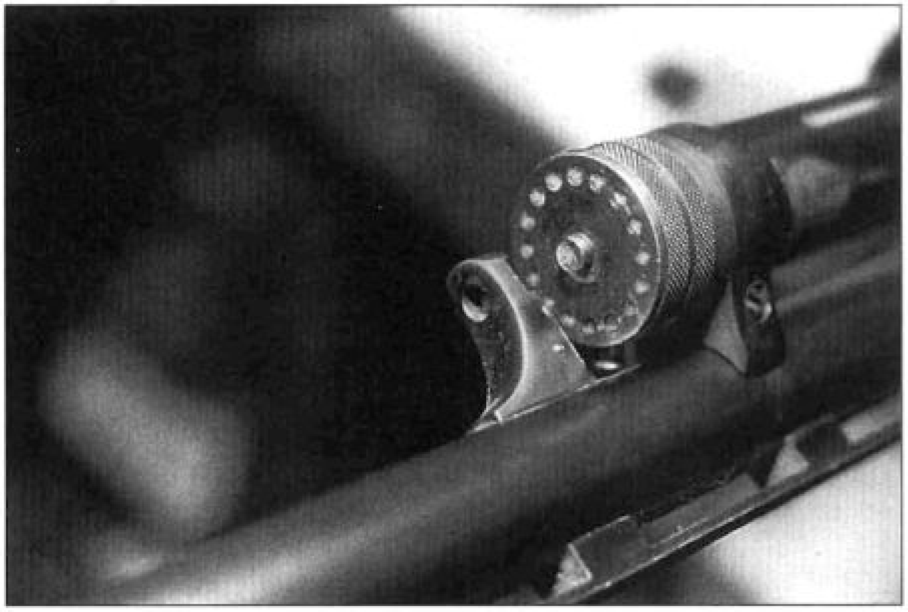


When the action is opened, you can see the lifter legs.



With the magazine cap screwed down until it clears the barrel…

…you can pivot the barrel (with the action Open!) and remove the barrel…



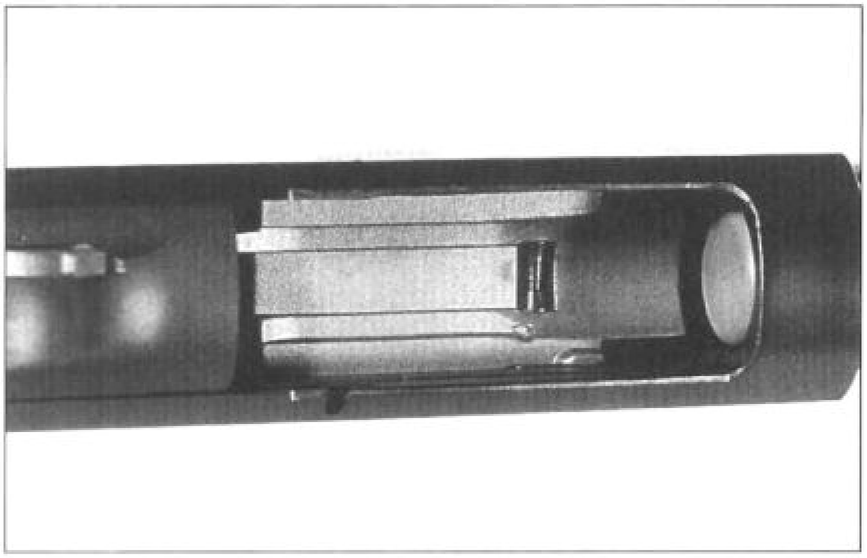
Ithaca Model 37

Derived from the Browning-designed Remington M-17, the Ithaca has been a favorite of left-handed shooters for decades. It is also one of the fastest and smoothest-pumping shotguns around. It has in this modern age, a peculiar trait: It does not have a disconnector. If you take a loaded Ithaca, fire the round, and then hold the trigger back, it will fire each time you slam it shut. You can empty an Ithaca in an amazingly short time doing this. Whether you can actually hit anything except the ground or empty sky is another matter. Many pumps did not have disconnectors in the old days, and shooters learned to get their finger off the trigger while pumping.

…then unscrew the magazine cap.

***Remove the buttstock before starting in on the action screws*.**

Today's shooter, pumping a shotgun with a disconnector, does not learn to get his finger off the trigger while pumping, and will often fire his second shot with an Ithaca before he is on the second bird or clay pigeon. I'm really fast with a pump, but I can't use an Ithaca at speed. I learned on a Mossberg 500, then went to a Remington 870. Every time I tried to speed up with an Ithaca, I ended up throwing shots between targets.



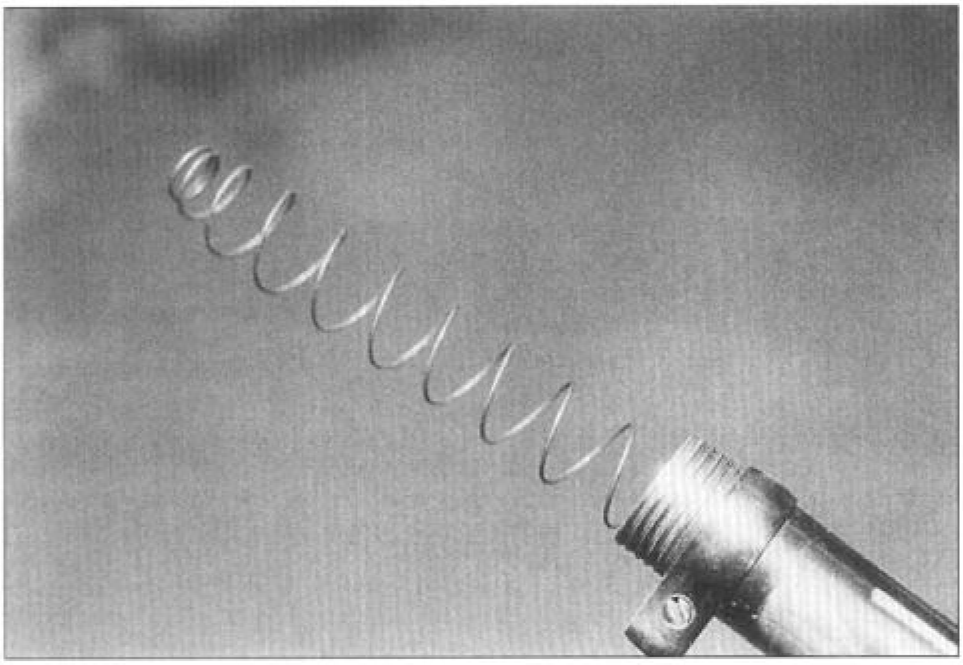
Unique among shotguns, when the Ithaca action is closed, the lifter rests above the bolt.

The Ithaca is light, tough and fast. The barrel is held in place by the magazine cap. Check to make sure the shotgun isn't loaded. Leave the action open. The Ithaca extractor rests in a slot in the rear of the barrel. If you try to remove the barrel with the bolt forward instead of back, you will be foiled by the extractor resting in its slot. You may damage the extractor, barrel or both. Turn the magazine nut towards the receiver, screwing it away from the barrel extension. The magazine nut has two small bumps on its side. These are the heads of the disassembly bar. If the nut is difficult to turn, press on a bump and you can push the bar out to the side. The added leverage of the bar, allows you to easily rotate the magazine cap. When the stud on top of the cap clears the barrel, turn the barrel a quarter-turn and lift it off the shotgun. The easy part has ended, and you will need screwdrivers to take the action apart. Before you can remove the trigger assembly you must take the buttstock off. At the rear of the receiver you will see two sets of screws. The upper ones, with their lock screws, are the pivot pins for the lifter. The lower one holds the trigger assembly in the receiver.

On the rear of the stock, remove the buttplate or recoil pad. With a large screwdriver, loosen and remove the stock bolt. Slide the stock off. You need to remove the buttstock first because while the stock bears against the receiver, it pulls tight to the receiver while attached to the trigger assembly. If you try to remove the trigger assembly screw without easing the pressure

from the stock, you will gouge the screw slot and maybe even strip the threads.

The Ithaca magazine spring is shorter than expected, but it works just fine.



With the stock off, unscrew the trigger assembly screw and remove it. Pull the trigger assembly out of the receiver. Hold the receiver upside down on your bench. In the bolt carrier you will see a small spring-loaded pin that is visible through a window. With a small screwdriver, press this pin away from the operating rod. Run the slide forward and out of the receiver. (If you have not removed the magazine cap the slide will stay on the shotgun.) Unscrew the lifter pivot pin locking screws, then the pivot screws, and pull the lifter out of the receiver. Slide the bolt and its carrier rearwards out of the receiver. If they have not already fallen out, pull the shell slops out of their slots in the receiver.

Cleaning the magazine tube on the Ithaca is the easiest of all pumps. Rotate the magazine cap to unscrew it. The spring and follower can then be pulled out. A curious note: The Ithaca spring seems too short, but isn't. When you pull the magazine spring out of other shotguns you may find it 4 or 5 inches longer than the magazine. Ithaca springs are an inch or 2 longer, and yet the Ithaca never fails to feed. Use a stronger or longer spring if it

makes you feel good, but don't go and replace the spring, thinking it has gotten weak and short.

Scrub the gunk off the parts and receiver interior. To reassemble, place the bolt onto the carrier, and slide them into the receiver from the rear. Replace the shell stops. Put the lifter in place, and make sure you get the curved are of the lifter towards the top of the receiver. Screw the pivot screws back in, and line up the notches with the locking screws. Tighten the locking screws in place. Push the bolt to the front. Place the trigger assembly in the receiver and tighten its retaining screw. Slide the forearm back so the operating rod goes into the receiver. Use your small screwdriver to press the catch pin aside, and slide the operating rod back until it catches the pin.

Tighten the stock back on, and replace the buttplate. Replace the barrel.

Winchester Model 1897

The '97 starts out easy, but gets difficult on the take-down models. On the non-take-down models, it is simply a bit of work. To remove the barrel and break the shotgun down for basic cleaning, look to the end of the magazine tube. On the upper left next to the barrel of the take-down models is the disassembly pin. Non-takedown models lack this pin. Press the pin down, and when it sticks out of the other end of the tube, pull it until it stops. Using the pin as a lever, rotate the tube a quarter-turn. Slide the tube forward out of the receiver, and then slide the forearm forward until it stops. Grasp the magazine tube and barrel right in front of the receiver and turn it a quarter-turn. Pull the barrel and magazine tube assembly off of the receiver. Leave the hammer cocked.

You will need screwdrivers for the rest of the disassembly. On the upper rear of the receiver, near the hammer, you will find the carrier pin stop screw. Unscrew it. Press the carrier pin out of the receiver. On the lower right side of the receiver, above the trigger guard, you will find the shell guide stop screw. Remove it. Press the action release button and hold it down. Use a screwdriver to pry the carrier down from the bolt until it has moved enough that you can pull it down and out of the bottom of the receiver.

To remove the bolt, use a screwdriver to loosen and remove the screw that holds the action slide hook. Remove the hook, and then slide the bolt backwards out of the receiver. To remove the trigger assembly you will

have to remove the buttstock. That, and how to disassemble the solid-frame model, will be covered in Chapter Twelve.

Scrub, lubricate and reassemble. Slide the bolt into the receiver and run it forward. Place the action hook on the bolt and lighten its screw. Push the carrier assembly up through the bottom opening, and press the action lock for clearance as the carrier comes to the rear. Press the carrier pin through the receiver. Be sure to get the notched end on the side with the carrier screw. Press the carrier up against the bolt. Replace the shell guide stop screw. Take the barrel assembly and with it turned a quarter-turn clockwise, slide it into the front of the receiver. Turn it until the magazine tube lines up with the clearance hole. Press the magazine tube and slide back into the receiver. Turn the front pin, and the magazine tube itself, a quarter-turn counter-clockwise, and then press the pin through the tube until it is resting alongside the left side of the barrel.

The Winchester Model 12

The Model 1912 was an advance over the 1897 in many respects. The hammer is internal and the receiver has smoother lines. On the '97 the carrier (lifter) is a large and machined chunk of steel. On the Model 12, Winchester trimmed it down considerably, until it was a flat tongue. Still made of forged and machined steel, it is much lighter than the carrier of the '97. The lighter weight is one of the reasons the Model 12 is such a fast-pumping shotgun.

Check to make sure it is unloaded. To disassemble the Model 12 you start with the exact same method as you do on a take-down Model 97, by removing the barrel and magazine tube assembly. With the front half off, turn the shotgun over. Behind the trigger guard is a single screw. The trigger guard is held in place by this screw and a shoulder at its front that hooks into the receiver directly behind the opening for the cartridge lifter. Turn the screw out and remove it. The trigger guard can then be removed by lifting the rear of it out of the receiver, and then pulling towards the buttstock. With the trigger assembly out, you need to remove the ejector and shell stop. With a small screwdriver, gently pry the ejector out of its hole in the receiver. Then remove the shell stop. The bolt will be locked into the receiver. The lock is on the side of the bolt away from the ejection port. To unlock the bolt, reach in with the screwdriver and press the rear of the lock

lever into the bolt. With the bolt unlocked, pull it to the rear and upwards to remove it from the receiver.

Scrub and lubricate the parts. Insert the bolt into the receiver and press the front of the bolt lock lever to lock it in place. Slide the ejector into its slot in the bolt and press it forward until it pops into its hole in the side of the receiver. Slide the shell stop into the receiver and into its slot between bolt and receiver. Press the front of the trigger assembly into the receiver and pivot it down until it is flush with the receiver, and replace the trigger guard screw.

The barrel and magazine tube assembly go back into the Model 12 in the exact manner as on the 1897. (Despite their being operationally identical, the barrel and magazine assemblies of the 1897 and the Model 12 are not interchangeable.)

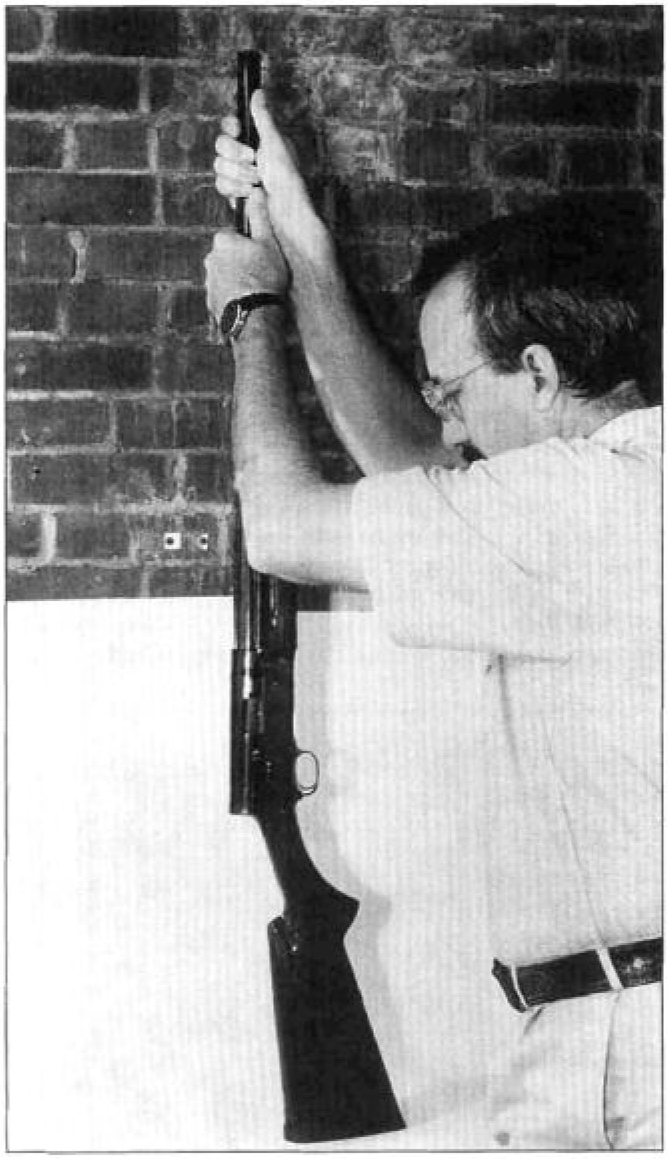
Browning A-5

The Browning shotgun was the first dependable self-loading shotgun. While he had many competitors in the automatic pistol field (not that their numbers helped, Browning still prevailed), John Browning was alone in conceiving and designing a self-loading shotgun. As he held the patents, he could and did license its manufacture to several firms at once. You may run into Brownings, Remingtons. Savages and many others that all work the same. They are all Browning A-5's in operation even if their parts are not interchangeable.

The disadvantage of being first is the legacy of old concepts. Unlike newer designs (starting with the Remington redesign of their shotgun lines right after World War II), the A-5 can be a hassle to take apart. Modern shotguns come apart with a couple of drift pins, and leave you with a few large assemblies. When you are done stripping your A-5, you'll have at least 10 screws on the bench along with the receiver and its internals as individual parts. The screw slots on Brownings are narrower than any other screws you are likely to run in to, and you should specially grind screwdriver blades to fit them.

The Browning action is called the “long-recoil” action. At lockup, the bolt is locked to the barrel. Upon firing the barrel and bolt recoil to the rear of the receiver while they are still locked together. At the rear, the bolt unlocks, and the barrel goes forward. As it runs forward, the barrel ejects the empty. The next shell has been traveling with the bolt, pressing on the

bolt-mounted shell stop. Without that shell, the action would lock open. With the second shell now under the bolt, the bolt follows the barrel forward. Running forward, the bolt chambers the round. The bolt and barrel each have their own recoil spring. The bolt spring is in the buttstock, while the barrel spring is around the magazine tube, hidden by the handguard.



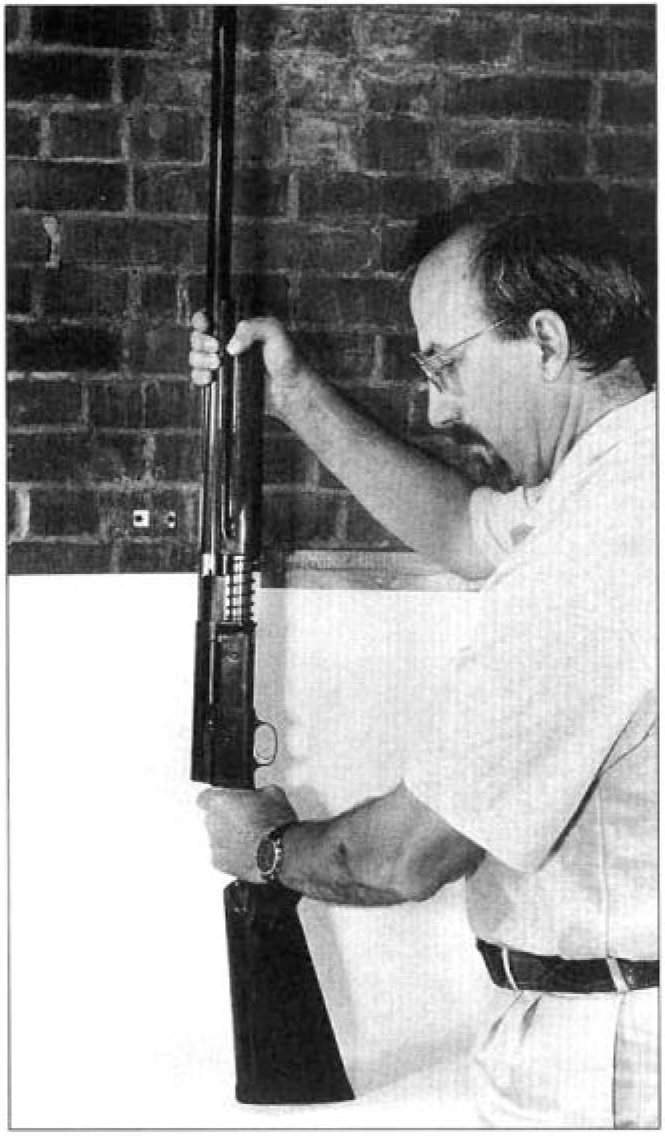
Lock the bolt back and press the barrel back into the receiver.

To disassemble the A-5 make sure it is not loaded. Lock the bolt to the rear. Place the butt of the shotgun on your bench with the barrel vertical and

grasp the barrel. Press the barrel against its spring back into the receiver an inch or 2. Let go with one hand and unscrew the magazine cap. Remove the cap and slide the forearm off the magazine tube. While the forearm is supported on the shotgun, it is relatively strong. Off the shotgun the forearm is a hollow shell that you can easily damage if you are not careful. Place the forearm someplace where it cannot fall or have anything heavy set down on it. Ease the barrel forward and remove it from the magazine tube. Remove the recoil spring and friction rings.

Grasp the operating handle of the bolt and hold it to the rear. On the side of the receiver just under the ejection port is a button. It is the bolt release button. Press the button and ease the bolt forward. If you do not restrain the bolt, it will slam forward and stop when the handle strikes the front of the ejection port. If you look closely at enough used Brownings you will see the ding this creates.

Unscrew the magazine cap…



…and remove the barrel and forearm.

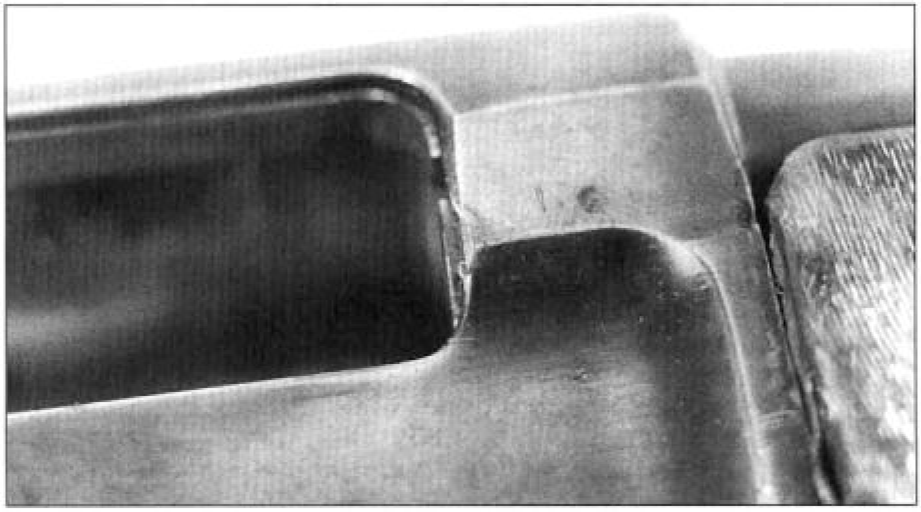
Now get out your screwdrivers. There are many screws on the Browning, and they are all fitted to the receiver. In order to get them back correctly I lay the screws out in the pattern they are in when in the receiver.

Press the bolt latch and ease the bolt forward.

Turn the receiver over and look at the lower tang behind the trigger guard. You will see three screws. The closest one to the trigger guard locks the hammer spring in place. Leave it atone for now. It comes out much later. It is not uncommon to see this screw slot chewed up from attempts to remove it too early in the process. The hammer spring tension must be relieved or its tension will be too great for the screw to be removed.

Turn your attention to the rear pair. The smaller one is a lock screw. Remove this small screw, then unscrew the larger one. The large one holds the stock on, passing through it to the upper tang.

With the screws out, place a disassembly pad or folded towel at the edge of your bench. Hold the stock in one hand and the receiver in the other, and tap the rear of the receiver against the pad. The stock will slide off. Set it aside.

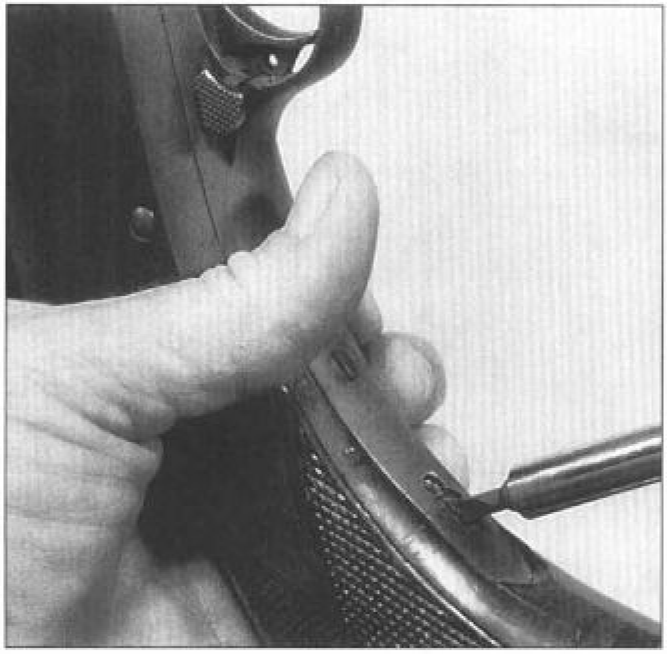


If you let the bolt slam forward when the barrel is off, you'll kick up an unsightly burr.

Turn the receiver onto its right side. On the left side of the receiver just above the trigger guard are the trigger assembly screws. As with the tang screw, the smaller-headed screws are lock screws. Remove the lock screws and then the trigger assembly screws. The trigger assembly is tightly-fitted and may require some forceful pulling to extricate it. With the trigger assembly out, turn the receiver upside down. On the inside of the receiver on the side away from the ejection port is a leaf spring. This spring activates the lifter. At its front end it is hooked under a stud on the lifter. Press the tip down and then to the side to free the spring. With the tension relieved, slide the spring off of its pivot post. (Some Brownings have the spring attached to the trigger assembly housing.) Turn the receiver onto either side. The large-headed screws are the lifter pivot pins. The smaller screws are their lock screws. Remove the lock screws and then the lifter pivot screws. Pull the lifter (one or two-piece) out of the receiver.

The tang screw has a locking screw.

At the rear of the receiver extension you will see a small wooden or plastic cap. The cap holds the bolt spring in place. The crosspin just forward of the extension tip holds the cap in place. Carefully clamp the receiver in a padded vise. With the thumb of one hand press the cap into the tube slightly, and with a drift punch press the pin through and out of the tube. Ease the cap and spring out of the tube. There should be a cap on the forward end of the spring, which engages the bolt link. If it doesn't come out on its own you may have to push it out after you have removed the bolt.



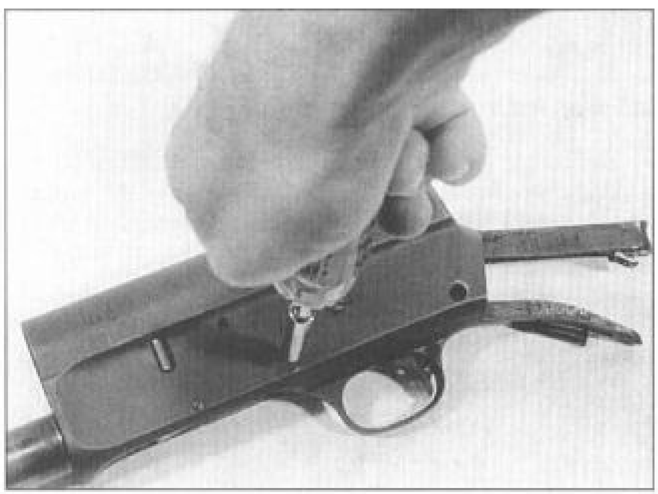
Loosen the tang screw…

…then lift it out.

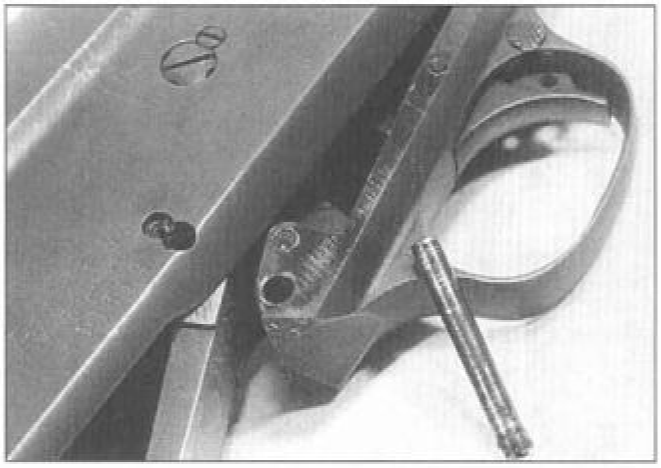
*To remove the buttstock (once the tang screws have been removed) tap the rear of the receiver against a pad on your workbench***.**

You cannot remove the bolt until you have taken off the locking block latch. Look on the lower edge of the ejection port. You will see a semi-circular cut. On the other side of the receiver is a hole, in line with this cut. The bolt lock latch is held in place by a pin through the bolt block. Slide the bolt backwards or forwards until the pin in the bolt lines up with the hole and notch. Use a ⅛-inch drift punch to press the pin out of the receiver. Insert the punch on the far side, and push the pin out of the bolt out through the ejection port. Lift the bolt lock latch and its spring out of the bolt.

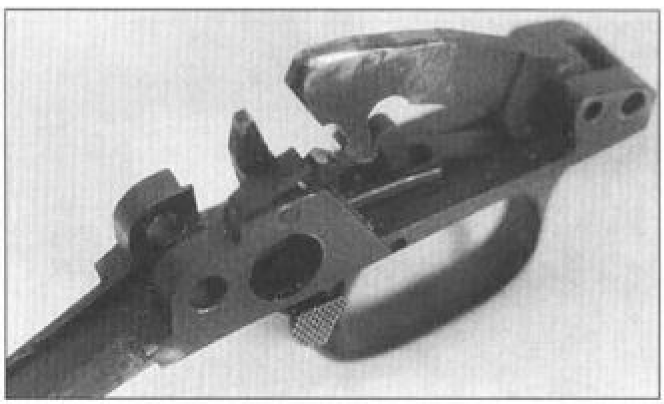
With the stock off, remove the locking screws and then the trigger assembly screws, rear…



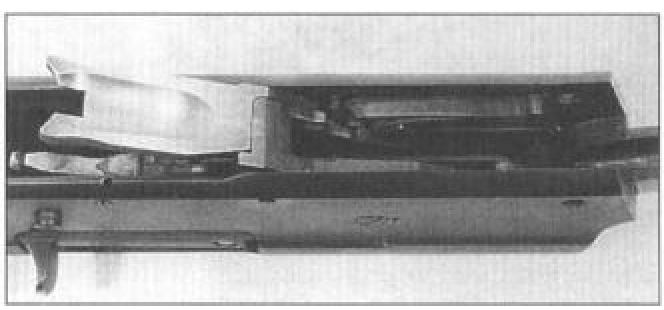
…and front.



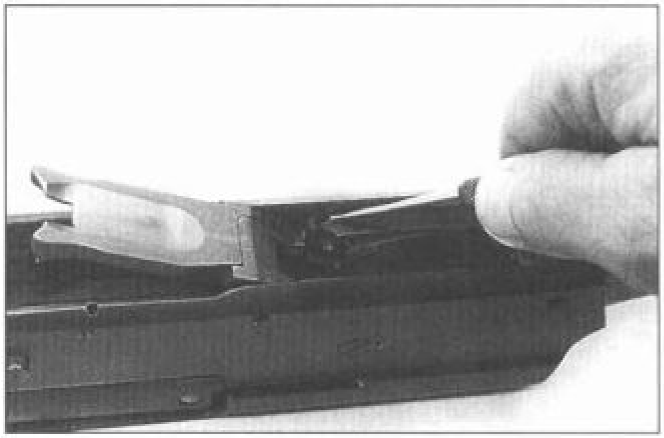
On the Remington 11, the front "screw" is a pin, held on by its locking screw.



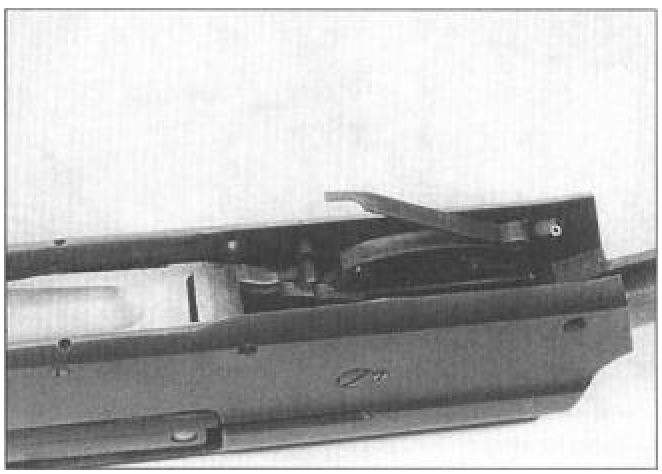
The Browning A-5 trigger assembly is one of many technical leaps John Browning assembled into his brilliant shotgun.



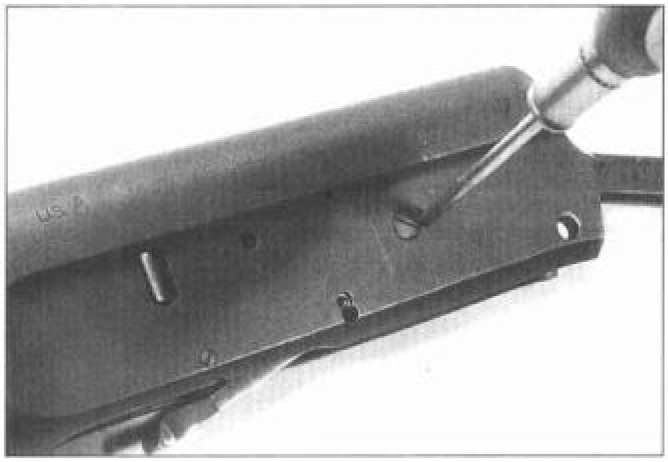
The lifter (in this shotgun a two-piece lifter) is powered by a spring on the left side.



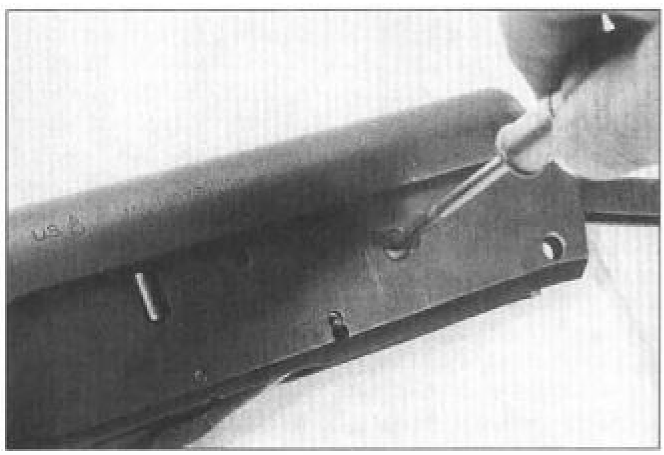
Push down on the front leg, and pry it away from the receiver wall.



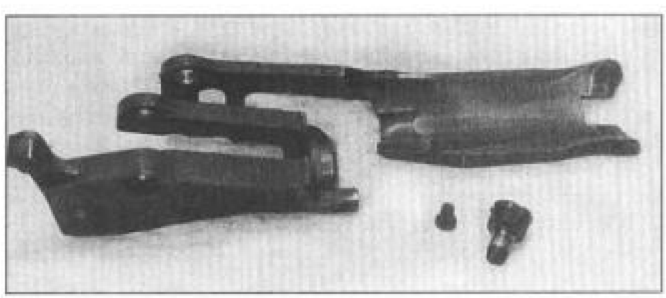
With the spring free, you can now slide it off of its rear pivot post.



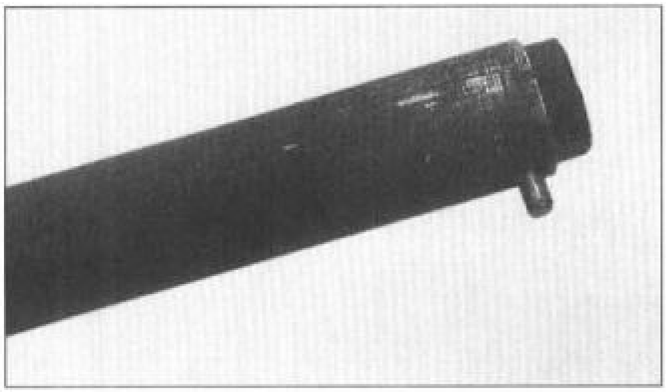
The lifter pivot screws have locking screws also.



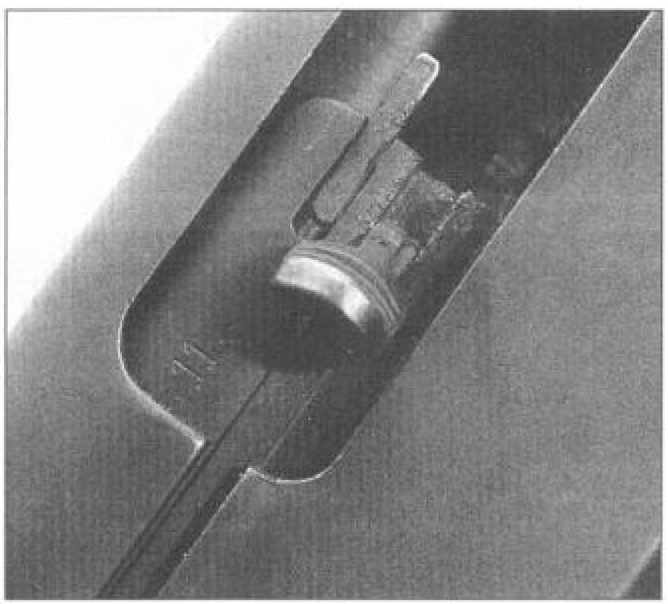
With the locking screws out, remove the lifter pivot screws.



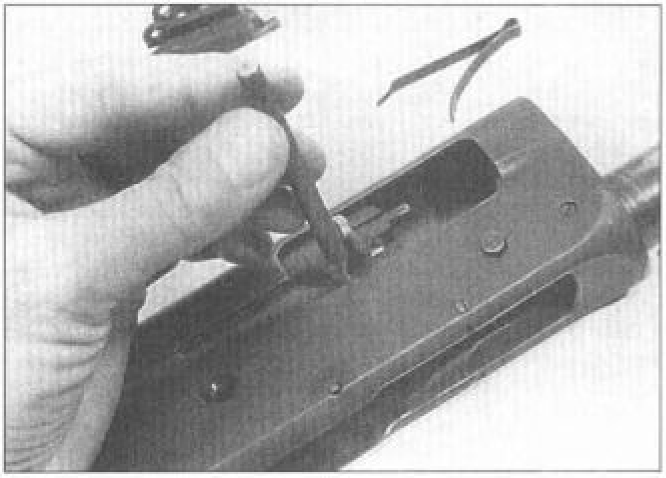
This is a photo of the two-piece lifter, with one pivot screw and its locking screw.



Here you see the tang extension, the spring retainer and its cross pin.

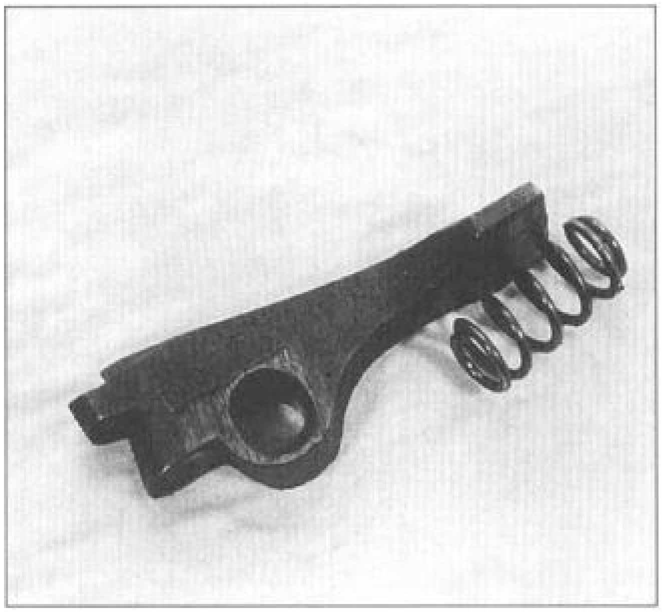


On Browning shotguns, the lower edge of the ejection port has a grove in it for the disassembly of the bolt. Remington 11's do not. The shell stop pin is right underneath the operating handle.



With the bolt retracted to line the pin up with its clearance hole, press the pin out of the receiver

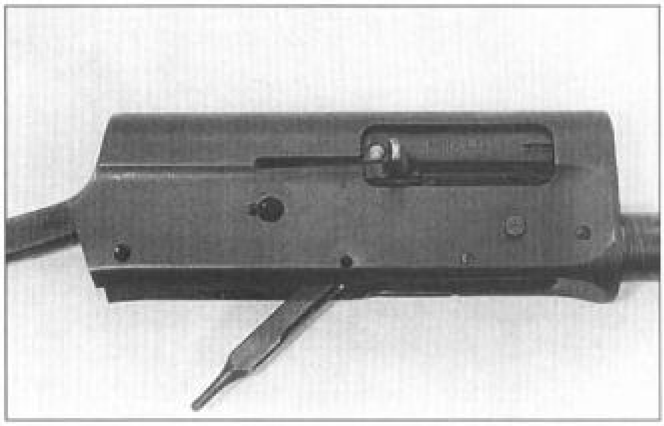
Here the shell stop pin is sticking out of the side of the receiver. Yes, it will have a collection of gunk with it.



The bolt-mounted shell stop and its activating spring are shown in this photo. The hole is oval so the stop can move out of the way when you are loading the magazine, but the spring pushes it back into line.

Swing the link out of the way of the operating handle and slide the handle to the rear out of the bolt. The bolt is now free to slide out of the front of the receiver. Slide the operating handle forward and out of the ejection port.

Scrub and lubricate everything. Use a bore brush to clean out the upper tang extension. It spends all its time in the stock and is prone to rusting. Give it a good swab with a patch of Break Free before reassembling it. Reassembly is the proverbial “reverse the disassembly procedure” but there are a few tricks to know. Fish the operating handle in through the ejection port and slide the bolt into the receiver. Marry the two up. To insert the pin for the bolt lock latch, first line its bolt hole up with the notch. Press the pin into the bolt just far enough to hold the pin in place. With the receiver upside down, place the bolt lock latch spring and bolt lock latch into the bolt. Press the latch down against the spring with one hand while pressing the pin with another. When the pin moves, you have captured the latch. You can now use a drift punch to press the pin the rest of the way home. Slide the bolt forward and leave it there.

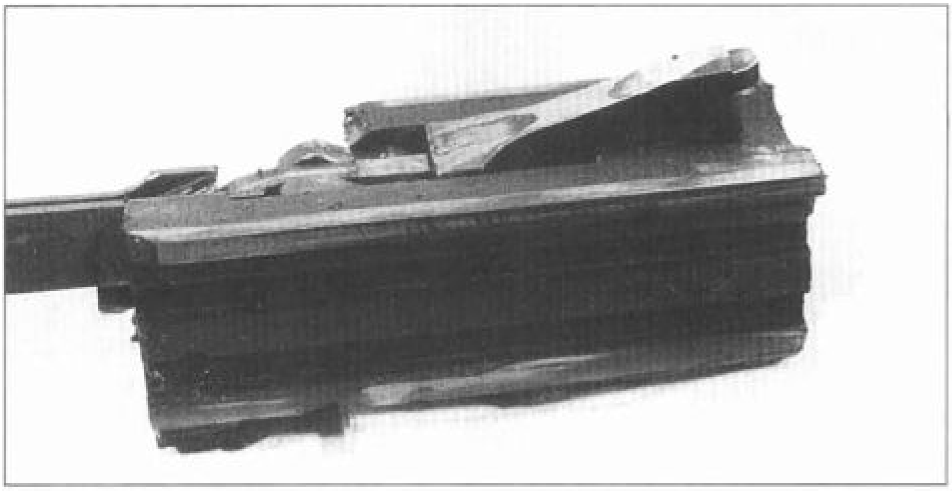


To remove the operating handle you have to pivot the link down out of the way.

Pinch the pin between your fingertips and pull it out of the receiver.

For the bolt spring, start the spring and its link cap into the tube, and then press the link down into line with the tube. When the link cap pokes through into the receiver it will catch on and retain the end of the link. Grasp the tube with your left hand, thumb to the end of the tube. Press the spring in place with your right hand. Clamp your thumb over the tube to

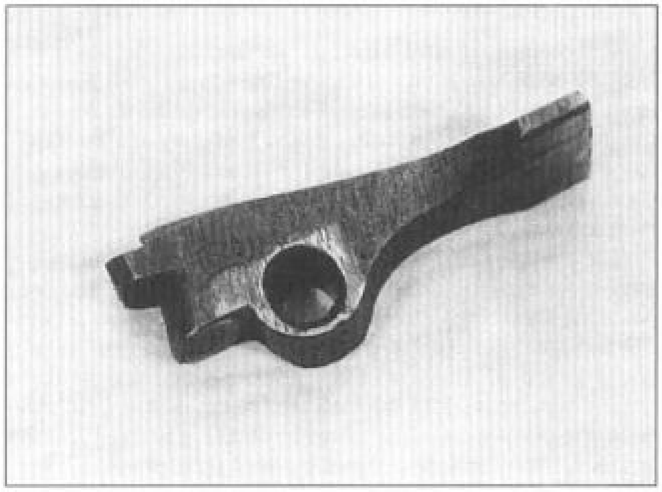
retain it and then press the retaining pin through the cap. Place the lifter into the receiver and loosely screw the pivot screws in place. Once both are in place, tighten them and then back them off just enough to line up with the locking screws.



Inside the receiver, this is the relationship between the bolt and shell stop, with the muzzle being to the right in this photo.

Hook the lifter spring over the pivot pin, and then press the forward end down and under its retaining stud. The lifter spring will press against the trigger assembly. To hold the trigger assembly in place, put your right hand on the receiver at its rear, fingers over the top. Press the trigger assembly into place with your left hand and hook your right thumb through the trigger guard. Move the assembly back and forth until the holes line up. Hold the trigger assembly in place with your right hand while you press the screws through with your left. Tighten the trigger assembly screws and their locking screws.

Slide the receiver tangs into the buttstock until they stop. Gently tap the butt of the stock against your benchtop to seat the stock firmly, and insert the tang screw.

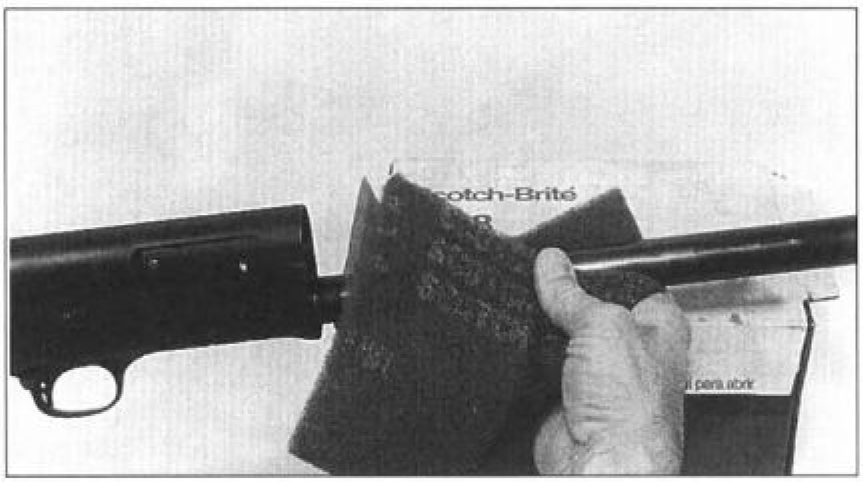


The shell stop is just a humble part, but one I have never seen broken or worn out. The shell stop on the bolt feeds shells from the magazine and travels with the bolt.

On reassembly, line up the bolt with the clearance hole and press the pin part of the way back into the receiver. Press it just enough to catch the bolt, but not enough to prevent installation of the shell stop.

To install the barrel, lube the outside of the magazine tube. Slide the recoil spring and friction rings over the tube in the appropriate order. Lock the bolt back. Stand the A-5 upright on your bench and slide the barrel over the

magazine tube and into the receiver. Grasp the barrel and pull it against the recoil spring. Hold it there and slide the forearm in place. Tighten the magazine cap. Be sure the lip of the forearm slips into the retaining cut in the receiver. To check for proper assembly, slide the barrel into the receiver as far as you can, and tighten the magazine cap hand-tight. There should not be any slack between the magazine cap and forearm. I have seen quite a few shooters who “loosened the cap a couple of clicks” (for reasons they could not explain except that “I always do it”) and they are almost always the ones with cracked forearms on their A-5s. Keep it tight and the forearm won't crack.



Magazine tubes that are dirty, rusty or have congealed oil on them can be cleaned with a Scotchbrite pad.

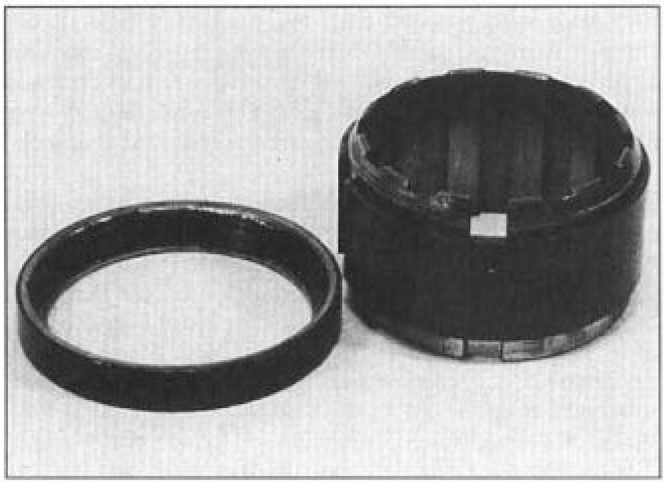
Remington 11–48

This Remington is a blend of old and new. While it is a long-recoil action right out of the Browning mold, it comes apart with two drift pins and no screws. Just like its ancestor, the 11–48 is durable to a fault, and you may see an 11–48 from time to time until we don't own self-loading guns any more. The only trick you need to know is when you try to put it back together.

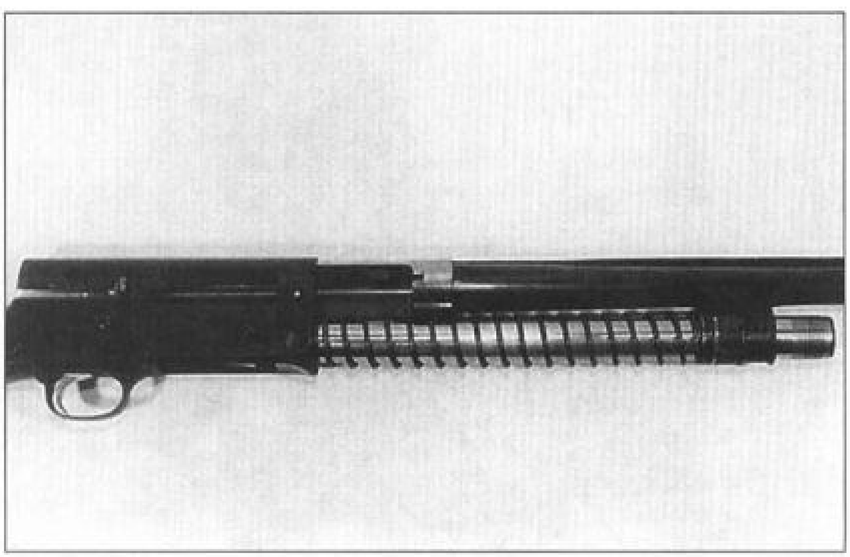
The shell stop is not staked in place, and is held in by the trigger assembly and the assembly pin. If you try to simply place the shell stop in the receiver and jam the trigger assembly in place, the stop will lean out and block you.

Take a feeler gauge of .008″ or .010″ thickness and use it like a tongue depressor. Hold the shell stop to the side and slide the trigger assembly down the gauge until it is in place. Press the assembly pins through and pull the feeler gauge out. Vôila.

Remington 1100 and 11–87

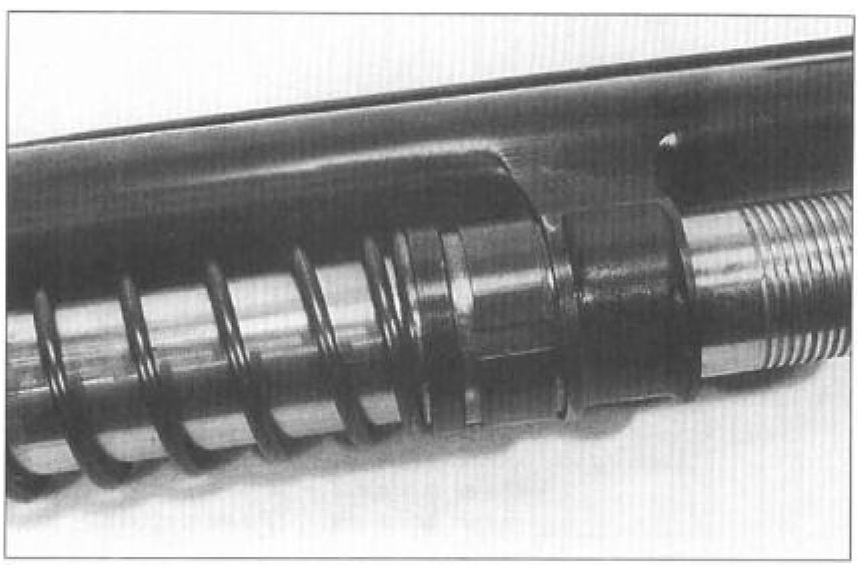


The friction rings of the Browning are shown here. The steel ring sits under the bronze ring.



***Here is the heart of the Browning A-5 long-recoil action. The recoil spring is longer than the space for it, and is under considerable tension when the forearm is in place*.**

Disassembly of the Model 1100 and the Model 11–87 is easy, and intentionally so. I will use “1100″ to describe the aspects of both the 1100 and 11–87 that are identical. Where the 11–87 is different I will use “11–87.” Make sure the shotgun is not loaded. Lock the bolt back. Unscrew the magazine cap and pull the forearm and then the barrel off. On the 11–87 barrel hanger there is a spring-steel clip that fits around the outside. The clip is the gas vent valve. A light load will not have enough gas pressure to move the spring, and ail the gas will be used to operate the mechanism. A heavy load will flex the spring, venting excess gas. Be sure you keep track of the clip, and get it back in place during reassembly. On a particularly dirty 1100 the gas rings may stay lodged inside the barrel hanger. Reach in with a fingertip and work them out. Grasp the operating handle and with your other hand press the release button in the middle of the lifter. Ease the bolt forward. Use a drift punch to press the two trigger assembly pins out of the receiver. Pull the trigger assembly out and set it aside. Grab the operating handle and pull it out of the bolt directly to the side. Hold the slide weight and pull it forward until it stops. The shell stops are preventing the bolt and slide assembly from coming out of the receiver. You will have to manually activate them to release the bolt. With a fingertip depress the shell stops.

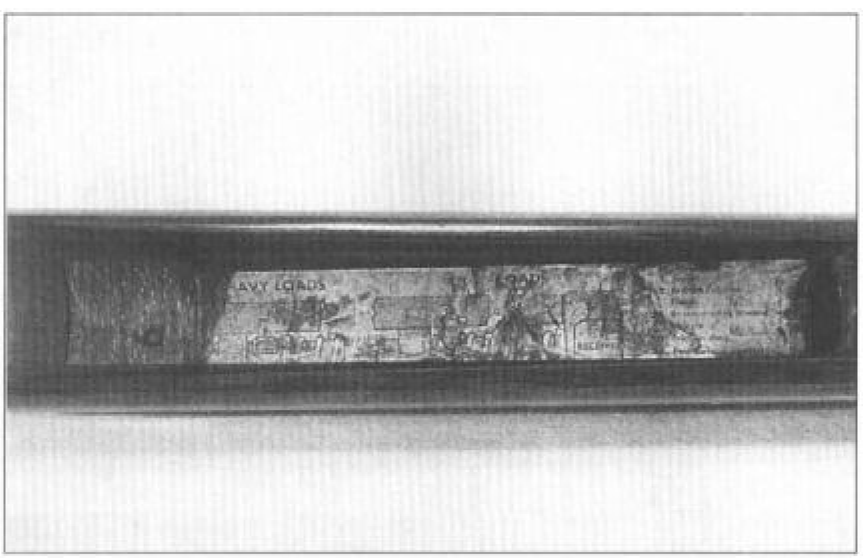


This Browning is set up for heavy loads.

The bolt rides on but is not fastened to the slide, so pick it off the slide as soon as it clears the receiver. The last thing left in the receiver that you need to remove for cleaning is the action fork. It looks like a tuning fork with a T-handle. The rear tips have knobs on them to keep them locked to the recoil spring front guide. Use a pair of needle-nose pliers to compress the rears of the legs, and pull the fork towards the muzzle. Lift the legs up, and turn the fork a quarter turn to free it from the guide slots. The receiver is now open for scrubbing and hosing.

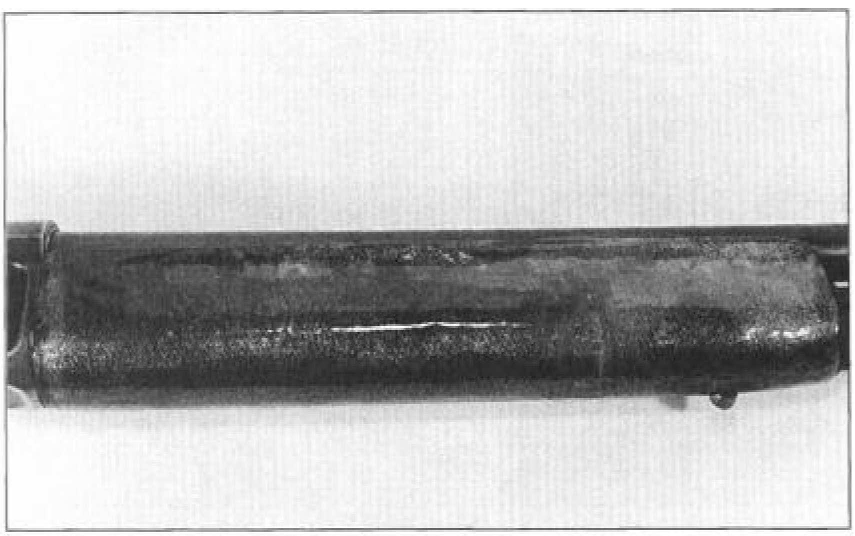
Scrub and lubricate everything. Pay particular attention to the outside of the magazine tube. Crusted and hardened powder residue on the tube can bind the gas system and lead to a single-shot shotgun.

The 11–87 magazine tube is made of stainless steel, and not likely to be rusted. However, the gas rings on both 1100 and 11–87 may have hard-baked carbon on them that will require vigorous scrubbing to get clean. Also, the rubber O-ring is prone to wear from firing and tears from heavy-handed disassembly. The older rings are black rubber. Newer rings are a metallized silver color, slightly thicker and stiffer than the old ones. It is worth the dollar or two to replace the old O-rings every other year with new ones. I have had many requests for a cheaper, industrial O-ring through the years. I have not found one, and even if I had I would not be very optimistic about an O-ring designed to hold water in a valve standing up to the heat and pressure of a shotgun shell.

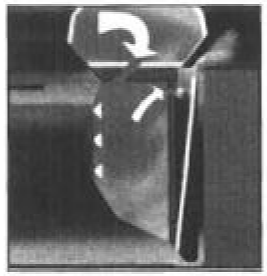


Browning ring stacking order is so important that there was a chart pasted into the forearm. After many years of use, most charts can't be read. If you don't stack them correctly, you can crack your forearm, creating the need for an expensive repair or replacement.

To reassemble, put the action fork back in place. Turn it slightly to gain clearance, and place it in the guide slot. The upward curve of the fork goes towards the top of the receiver. Grasp the tips with the needle-nose pliers and compress them enough to insert them into the recoil spring front guide. Place the bolt on the slide and insert into the receiver. Press the shell stops to clear the slide. Once in the receiver, install the operating handle. Slide the gas rings over the magazine tube (in the correct order, see Chapter 16.) Place the barrel over the tube and then stand it upright. With one hand, retract the bolt and with the other press the barrel into place. Slide the forearm on and tighten the magazine cap.

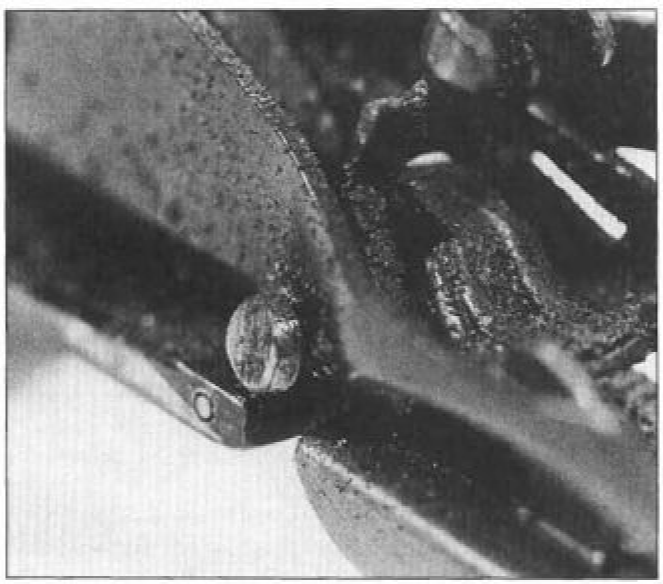


If you do not keep your forearm tight, it will crack. With enough cracking, the shotgun can become hazardous to use. This forearm was laminated with fiberglass cloth like a boat hull to prevent future cracking.

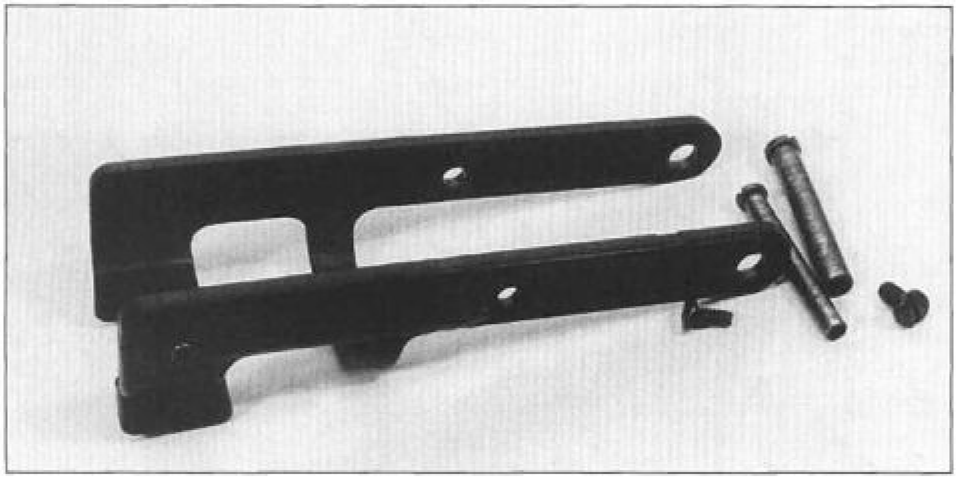


Self-loading shotguns now commonly use the combustion gases to work the mechanism. Not all do, but most. (photo courtesy O.F. Mossberg & Sons.)

To insert the trigger assembly you will have to tilt it slightly towards the large lever, the slide lock. The lock has a dog-leg in it, and it must fit into a recess in the side of the receiver. Once the lock has slid in, press the assembly flush to the receiver and line the holes up. Press the assembly pins through.

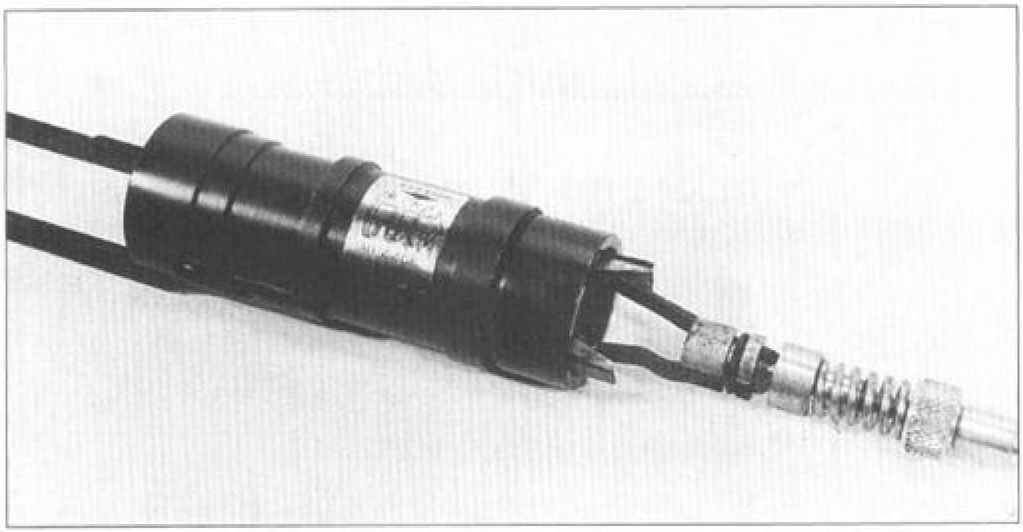


This very grubby 1100 has the loading gate latch pin replaced with a solid pin with a large head. It also needs to be scrubbed.



If your 1100, 11–87 or 870 has a USA speed loader, you need a screwdriver to disassemble it, not just a pin pusher.

Stocks and forearms don't need much for general maintenance. The finish on your wood is one of three types, oil, plastic or everything else. If your wood has an oil finish, then you need the same or a compatible oil finish to touch-up the old finish as it wears thin. The plastic finishes, all variants of polyurethane, are wonderfully hard, smooth and shiny. If your stock gets scratched you can use rubbing compound If you have wood with a lacquer, varnish or shellac finish (anything that isn't oil or plastic) then Birchwood Casey Stock Sheen can remove light scratches and clean up a stock. It has one “drawback” and that is that it tends to increase the shine of a stock. A dull stock is only an oil finish, as any of the lacquer or, varnish or shellac finishes will have some shine to them. The Stock Sheen is an extremely fine rubbing compound and wax combination. The rubbing compound cleans crud and old stock finish off the surface, while the wax leaves a sheen behind. My friend John Simon used Birchwood Casey Stock Sheen and Conditioner first on an HK SL-7 of his. By the time he was done he couldn't leave it in the rack at the gun shop because every other hunter who came in wanted to buy it. If you want your stock to stay dull, then you must find out from the manufacturer what kind of oil finish it is, and use only that oil or oil mix to refresh the finish of your stock.

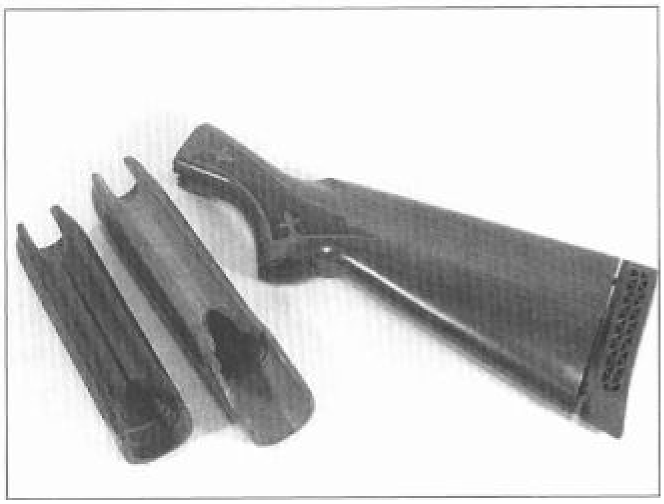


On 1100's with rusted action weights, a barrel hone will clean the rust out and get the gun working again.

This 1100 had the right-hand shell stop staked so many times the slot was worn out. By drilling and tapping it, the owner was able to get the shell stop to stay in place. However, the ugly factory has been raised greatly. The spring steel of the shell stop is so tough it took a carbide drill and four taps to get a threaded hole through the shell stop.

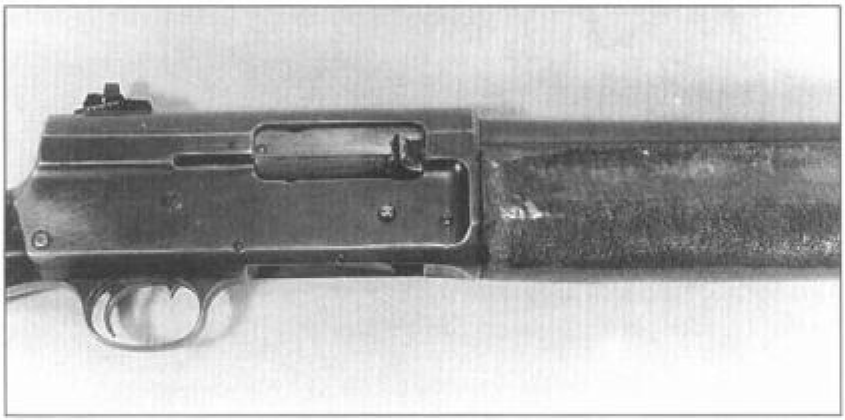
Plastic finishes require a bit more work. To clean up small scratches, use an extra-fine rubbing compound to blend the scratch. You are using up some of the thickness of the finish to do the blending, so do only as little as possible to make the scratch fade away. Then, an application of an

automotive paste wax will finish hiding the scratch. The polyurethane on your stock is the same type used in many other paints, yours just happens to be clear and with no pigment. If you use your shotgun hard, it certainly would be worth the effort to experiment with a couple of different waxes to see which works best, lasts longest, and works with your particular formula of finish.



Wood doesn't need much, provided you haven't used your shotgun as an oar. The best investment for a working gun is spare wood, for replacement or practice at refinishing.

Chapter 5
Stocks and Woodworking



Traditionally, shotguns do not have rear sights. This one is set up with an aperture rear for shooting slugs.

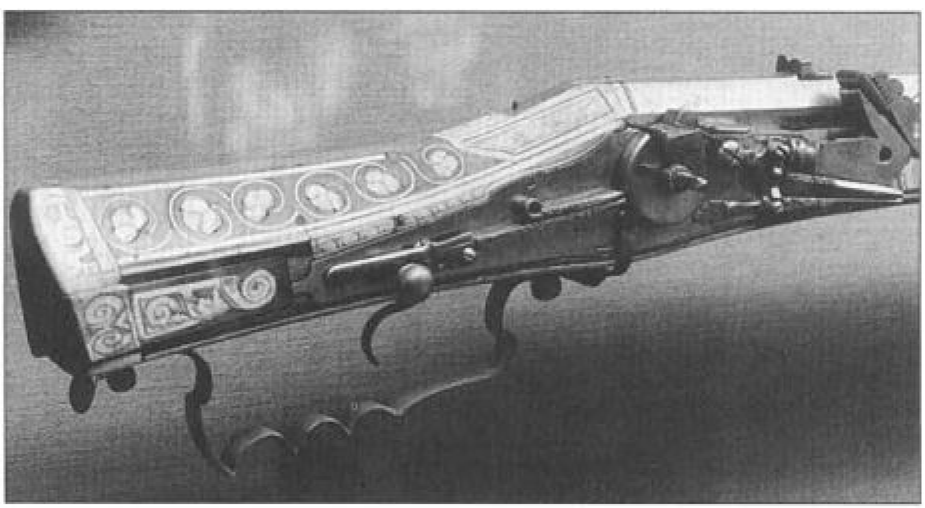
Unlike rifles and handguns, shotguns do not have a rear sight. Well, traditionally they don't. Shotguns intended for use with slugs for deer hunting, or for use as turkey guns or for self-defense shotguns quite often have rear sights. But traditionally, shotguns have only a bead front sight. The location of your aiming eye in relation to the rest of the shotgun is supposed to be enough of a rear sight. For an experienced shooter using a gun that fits him or that he is accustomed to, the practical result is good enough. If the shooter is new, or the shotgun just doesn't fit, the results can be frustrating. Many pages have been written waxing rhapsodic about the fit of this gun or that, and the fussy and ancient gunsmith who fits them. Some guns seem to seek out the targets themselves, and are already “on” the moment the butt touches your shoulder. A little secret…the British shooters who shoot so well, and who seem to bring down everything that flies or runs by, have lots of money. Enough money to afford custom-made shotguns, and enough money to hire professional instruction in how to use those shotguns.

You may not have as much money, but you can still benefit from their expenditures. If your eye rests in the same location over the stock each time

you mount the shotgun, you can eventually learn (some learn quickly) where it hits in relation to the bead. If you're lucky, it will even hit right at the bead. If your eye does not rest in the same location, you cannot learn the “trick” because there isn't one. Many shooters assume that if they get a fitted shotgun their aiming problems will be over. Not true. The problem is not just the length of the stock, or its drop, cast-off and cheekpiece, but how you mount it. If each time you throw the shotgun to your shoulder you do so in a different position, fitting won't help. Consistently mounting the shotgun in the same place is as important as good fit.

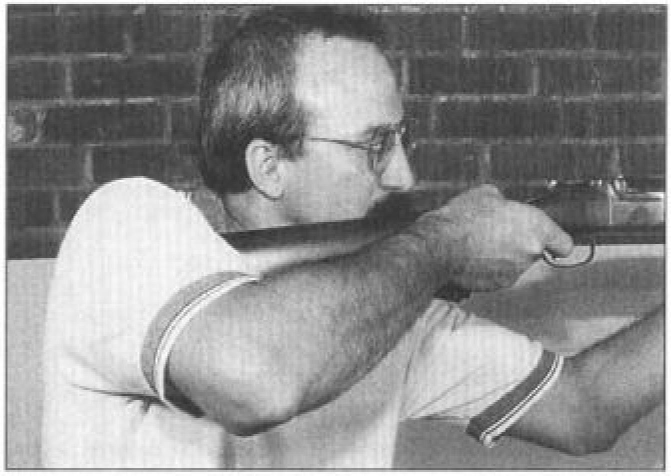
We have a dilemma. For many shooters, they can't shoot well enough to have any fun, and if they aren't having fun they won't continue. If they don't continue until they have an established routine, they can't get a shotgun fitted properly. So, buying a fitted shotgun isn't a shortcut, and now they've spent even more money on a frustrating experience.…

Early stock designs left much to be desired. While attractive in a showy way, this stock cannot be at all comfortable to shoot.



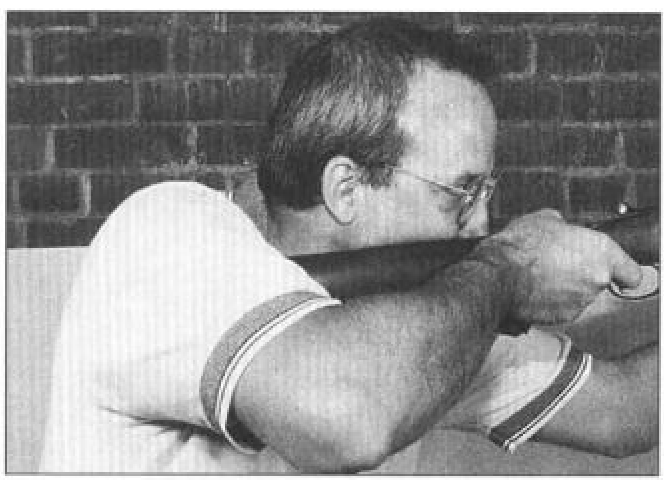
One solution is your gun club. Ask to try other members' shotgun (while they watch, of course) to see if there is any model that is more comfortable than your present one and lets you hit more targets. You could even organize a short league, where everyone uses borrowed shotguns (with factory ammo, of course, I'm not loaning my shotgun to be used with someone elses' reloads…) and uses a different one each week. In short order

everyone will have learned a great deal, and you may find the shotgun you need is soon to be the ex-shotgun of someone who also found a better hitter.

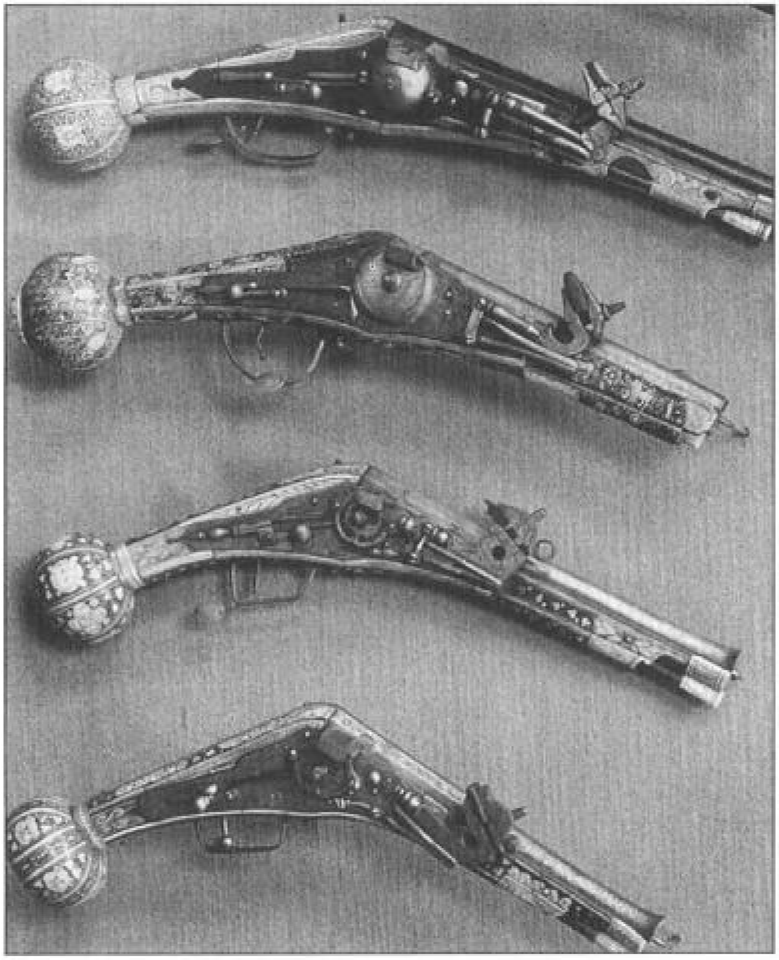


You must be consistent in your gun mount, or a fitted stock will be wasted time, effort and money. If one time you lift your head off the stock.…

If that shotgun is not for sale, you can buy one of the same model or you can modify your gun. By carefully noting the exact dimensions of the shotgun you were hitting so well with, you can duplicate it in your shotguns stock.

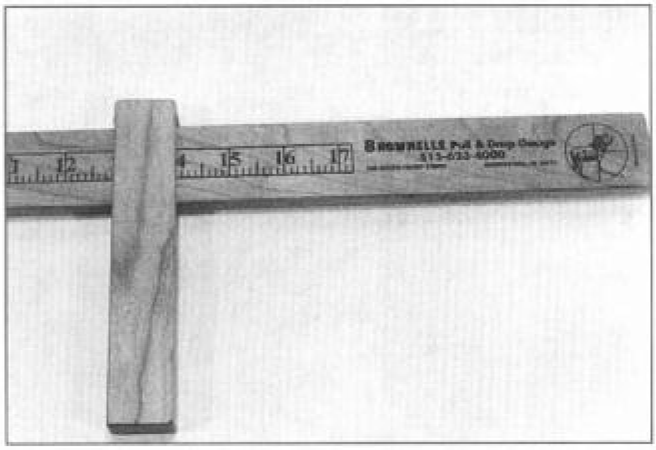


…and the next get a solid "cheekweld," your point of aim will be different with each shot.



The ornate stocks on these wheel-lock pistols were high-tech for their age. Stock design follows the needs and style of the times.

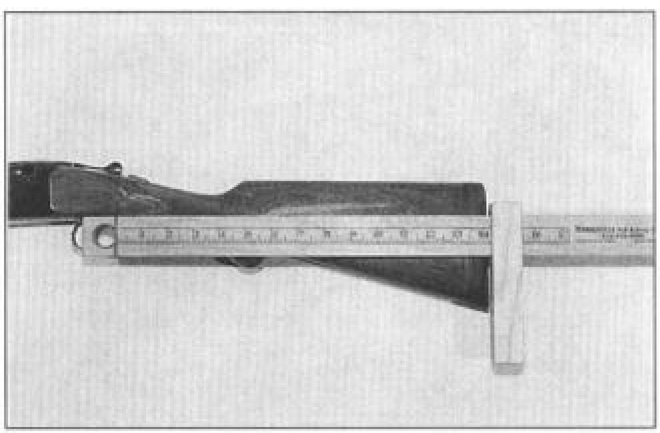
One approach to fitting a shotgun is the “ugly stick” method. Once you have an idea of what stock dimensions you need, you modify a stock to those dimensions. You definitely want to start on a stock that is the plainest of wood. You can use your current stock or you can get a replacement and start working on that. Sand or rasp your stock down, or build it up with epoxy and plastic wood. Practice with it and keep track of your scores. Once you have a stock that fits you, send it off to Fred Wenig. He can duplicate your Frankenstein stock in a very attractive piece of wood, so you won't have to hide your practicegun under a tarp.



You can determine length of pull with a tape measure, but measuring drop is not so easy. To be accurate you need a gauge like this one from Brownells.

What are the critical dimensions of a stock?

Before you go modifying your stock, you have to have an understanding of what each part does. Yes, we all know "put the butt to your shoulder, keep both eyes open and follow through" but sometimes that isn't enough. There are five critical dimensions that matter for fit. They are:



Measure length of pull from the face of the trigger to the center of the buttplate or recoil pad.

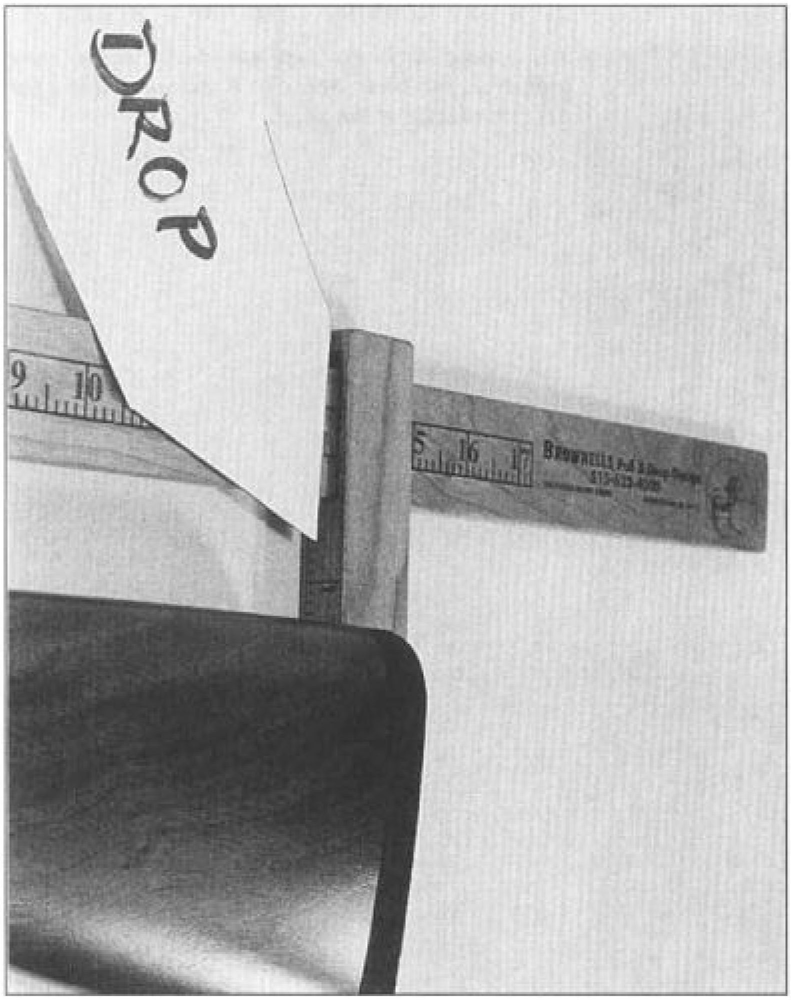
(1) Length of pull; the distance from the trigger to the end of the stock at its center.

(2) Drop; the distance down from the axis of the bore, measured to the heel of the stock from the bore or rib.

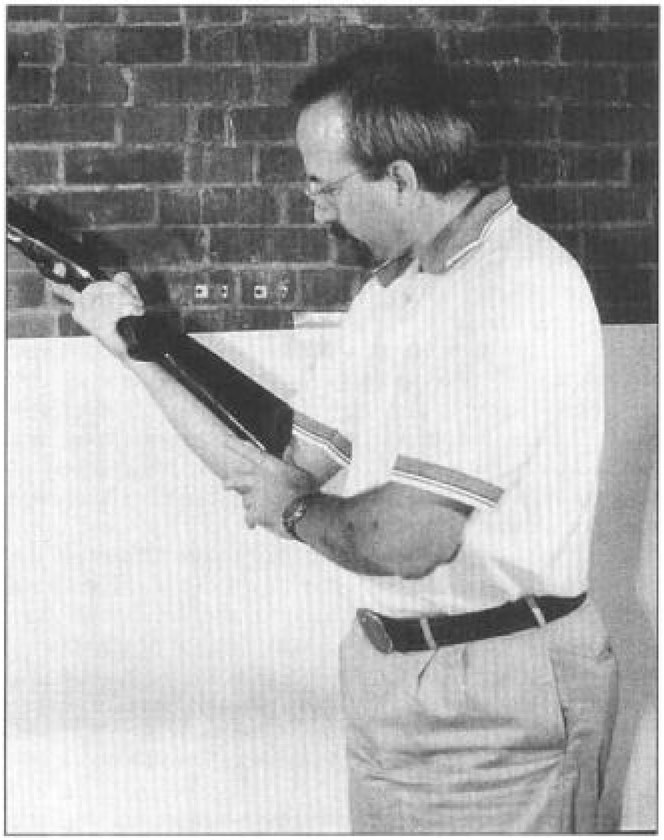
(3) Comb height; the distance down from the bore where your cheek rests, also measured down from the top surface of the barrel or rib.

(4) Grip pitch; the curve of the grip right behind the trigger guard.

(5) Grip diameter; the thickness of the grip where your trigger finger hand grasps the stock.



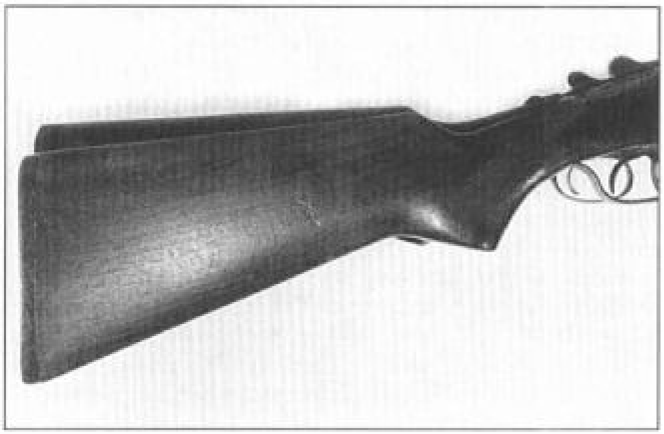
Drop is the distance down from the rib or center-line of the bore.



The traditional method of measuring stock length is to compare it to the distance inside your forearm. As a basic method, it is not too bad.

Each critical dimension has one or more less-critical dimensions that can have a bad effect on your shooting if they are too far from “normal.”

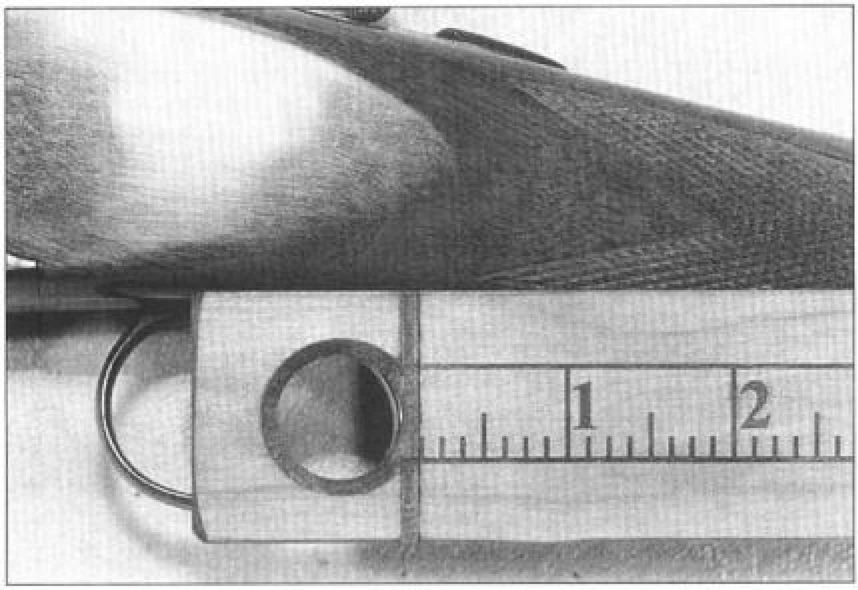
Length of pull The length of the stock by itself does not determine where your aiming eye rests, but a stock that is too long for you also probably has too much drop. The excessive drop puts your aiming eye too low. A stock that is too long can also make gunhandling awkward even with correct technique. How long is long enough? The traditional measure is the “elbow” distance. If you can rest the butt of the stock in the crook of your elbow and comfortably grasp the grip, the stock is the correct length. What the elbow test does not tell you is how the gun fits when you are bundled up for the cold.



***These two shotguns are lined up with their bores parallel. You can see that the nearer one has more drop. Given the same gun weight and cartridge, the nearer will kick harder*.**

Cast A minor dimension of length is cast. A stock with cast-off has the butt of the stock out from the centerline. A stock with cast-on has the butt inside from the centerline. Cast on or off depends on which side you shoot from. A stock cast-off for a right-handed shooter is obviously cast-on for a left-handed shooter. For most shooters, cast is not needed, but for some, like very muscular men or curvaceous women, it can be important. Cast in the stock brings the line of the bore to the line of your eye without you having to engage in contortions.

Drop This measurement matters because it effects your shooting style. If you shoot upright with your head erect, you need more drop. If you shoot leaned forward, with your head craned forward to the stock, you need less drop. If you square off to the target, you need less, and “bladed” you need more. A shooter who shoots a shotgun as if he was shooting a rifle at the target range will need a lot more drop in his stock compared to a shooter who faces the target as if it were a boxing opponent.



The Brownells gauge gives you a convenient hole to locate the trigger face against the gauge.

Pitch A minor dimension that goes along with drop is pitch. Pitch is the angle of the buttplate to the axis of the stock and bore. A stock with more pitch will slide up your shoulder under recoil, and strike your face harder than a stock with less pitch. Decrease pitch too much, and the shotgun could slide off your shoulder downwards under recoil, making follow-up shots difficult. A very muscular man has a problem. If he alters the stock to clear his chest (putting more pitch on the buttplate so the toe of the stock does not dig in) he will increase the jump of the stock into his face. The solution is cast-off to move the stock out to his shoulder, and off his chest.

Comb height The height of the comb determines the location of your aiming eye. The stock style known as Monte Carlo is an attempt to keep the eye up while getting enough drop in the stock for comfortable shooting. British stocks do not have Monte Carlo combs because the shooting style is to square off to the target as in boxing. A minor dimension of comb height is comb thickness. A comb that is too thick pushes your face away from the centerline, while a comb that is too thin encourages you to shoot with your head leaning over the stock. Shooting a shotgun with a thin comb hurts, because with your head over the stock, as the stock pivots up it has to push your head out of the way. Instead of sliding out of the way, your cheekbone gets whacked by the comb.

Grip angle The angle of the grip determines the angle your wrist takes upon grasping the shotgun. As the grip angle or curve becomes tighter, your wrist and shooting hand pivot the thumb back towards your face. The pivoting of your wrist changes the angle of the attached elbow. As your elbow moves lower, the “pocket” in your shoulder joint where the stock rests becomes less pronounced. If your elbow drops too much, the butt of the shotgun can move outwards under recoil, and you lose control of follow-up shots. A stock that has a tight curve that starts too close behind the trigger guard hurts your firing hand on recoil. The trigger guard can come back and whack your knuckle during recoil.

Grip thickness A grip that is too thick is difficult to grasp firmly, and can slide under recoil or during mounting of the gun. A stock that is at the maximum for your bare hand can become too large when you wear gloves.

All these dimensions change slightly according to how you are dressed. The poor duck or goose hunter, bundled up against typically goose-like weather, finds that he (or she) is not shooting the same shotgun used for practice. At least that's how it feels. And the gun certainly doesn't feel like the same shotgun that fit so well at the gun club or gun shop. What to do?

Checking for fit

Before you go cutting on a perfectly good stock you should determine if it fits or not. And if it does not fit, determine where it needs to be changed and by how much. The trial-and-error gun club method can work quite well, but you need an experienced observer to spot your shot cloud. Unless the observer can see your misses and where they are in relation to the clay pigeon, you won't know which direction you are missing in. I once spent a very frustrating afternoon trying to get a shotgun and load dialed on. My observer was having a heck of a time. The range was snow-covered, and there was a heavy and low overcast. He couldn't spot any of my shots, and I finally had to use trial and error to determine how much lead I needed for that load.

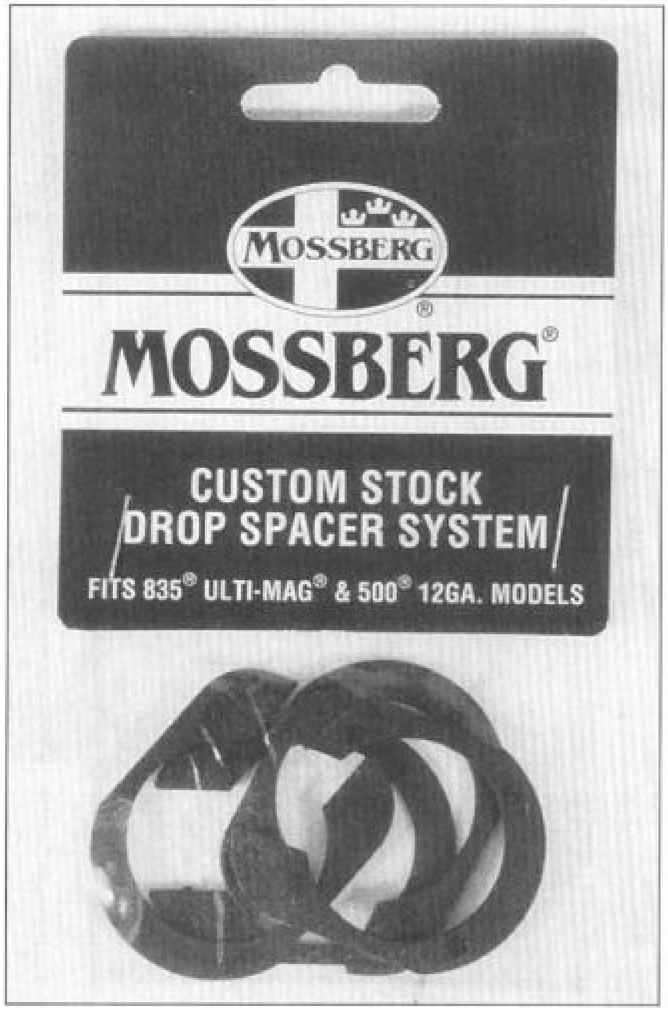
To check fit you need a stationary target. Otherwise the number of variables becomes too great to handle. The fitting check is called the Churchill method, after the British gunsmith who developed it. On a target stand or pattern board, mark your aiming spot with a dot of a couple of inches in diameter. Stand exactly 16 yards from the target. The distance is

important, as it determines the correction you will make on your stock. Use a tape measure if you have to, but get it exactly 16 yards.

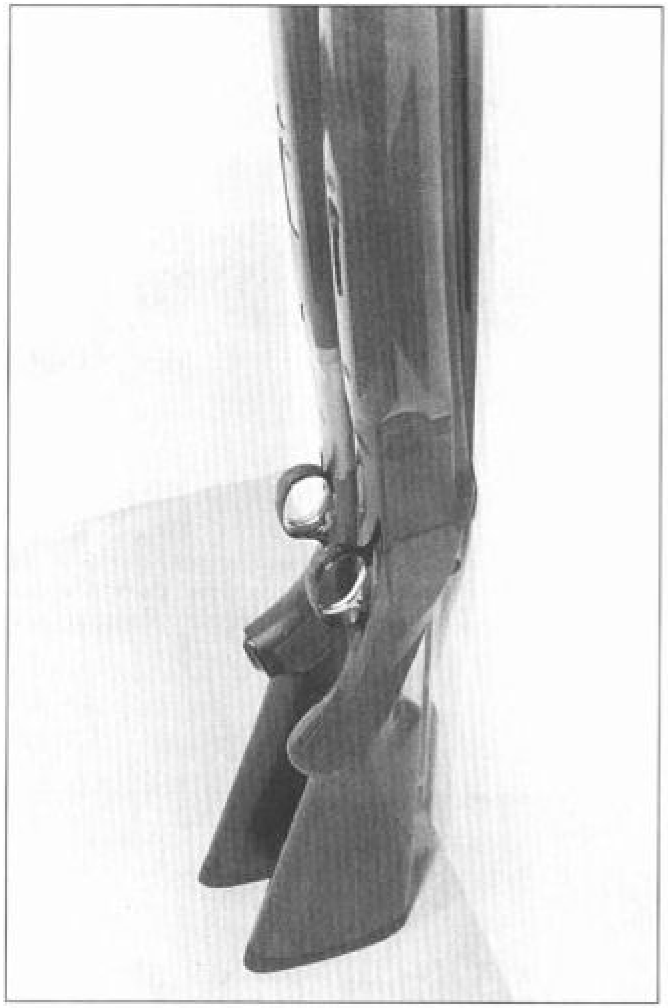
Face your target in your shooting position, but with the gun in low ready. When you feel ready, raise the shotgun and shoot without aiming. Don't rush the shot, but don't take your time and aim. You will have a hit somewhere near (we hope) the dot. Lower your shotgun and assume the ready position. On your second shot, forget where the first hit was. You do not want to “correct” your hit on the second shot, you want the shotgun to come up and fire the moment you are comfortable. If you slow down and aim, you defeat the intent of the exercise.

When I was first exposed to the Churchill method, it was explained to the as “a method of checking gun fit.” It is also a method of checking the consistency of your presentation. If you fire five times and the patterns are all in the same spot, you are either aiming or consistent. If your five patterns are all over the place, your presentation is not consistent, and altering the stock will not make any difference in your shooting.

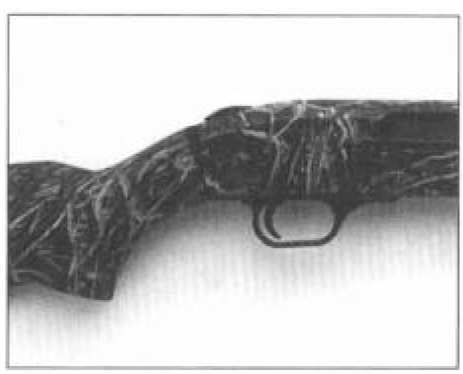
Trap guns and slug guns can come from the factory with a raised comb. The higher comb gets your eye higher to raise the trap pattern, or place your eye in line with the scope of a slug gun.



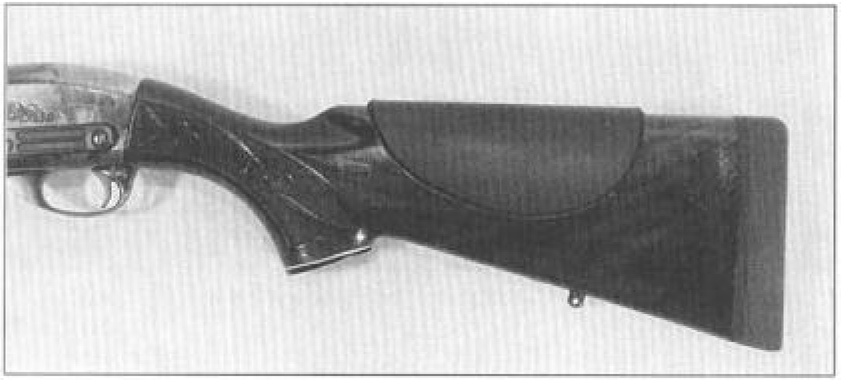
You can add drop to your stock if it is a Mossberg. These spacers go between the stock and receiver.



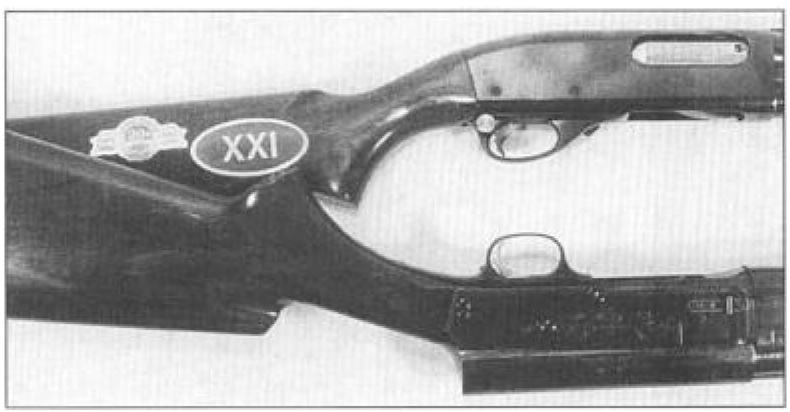
To measure pitch, place the butt flat against the ground and the top edge of the receiver against a vertical surface such as a wall or door jamb.



With the spacers in place, the angle between the stock and receiver changes. More drop makes it more comfortable for some shooters, less for others.

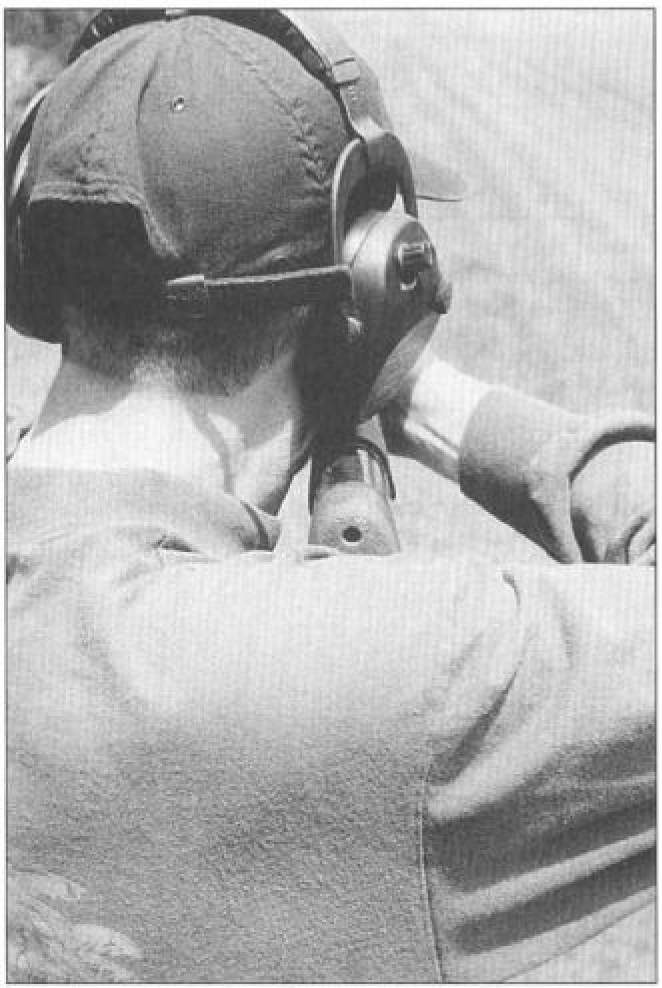


A rubber cheekpiece not only softens the impact to your face, but raises the pattern against the bead.

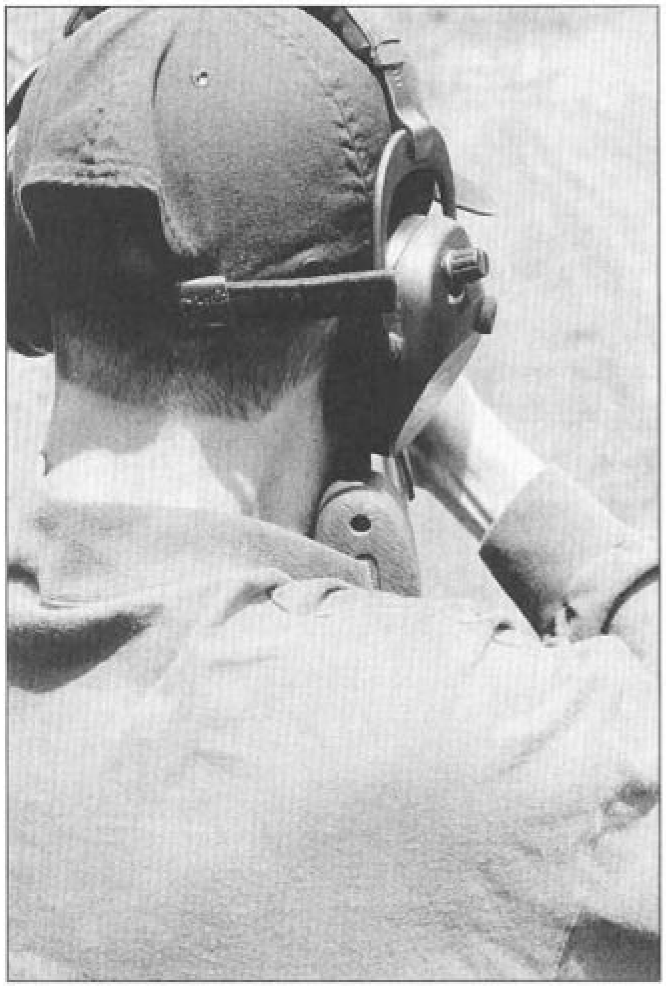


Grip curve has an effect on how you hold your elbow. The Remington stock, above, will force your firing hand elbow lower than the Browning stock, below.

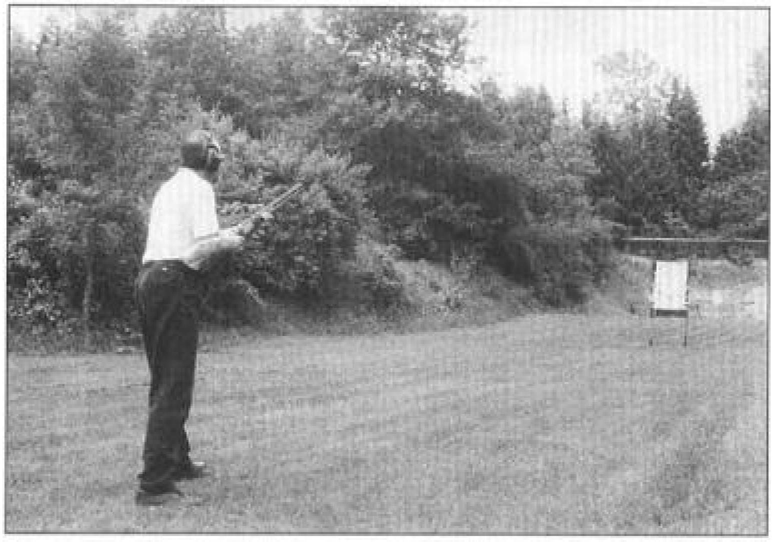
The grip diameter can be good or bad for your shooting. If too large, it is awkward and tiring. If too small, there is no place to comfortably place your hand, and trigger control suffers.



If, for one shot, the shooter mounts the stock out on the shoulder…



… and the next time mounts it in the shoulder pocket, his pattern will be delivered to a different place. Consistency matters.



***In the Churchill method, start with the gun down, a measured 16 yards from the target*.**

Assuming you have a consistent presentation, then we can work to alter the stock. Plot the centers of each of the five patterns, and come up with an average of their centers.

The Churchill method gives you a change to work with. For each inch the common center is from the dot, you need to correct the stock by 1/16 of an inch. In fitting a stock to strike the dot, the two important dimensions are comb height and width. Changing these two will move the pattern. Changing other dimensions alter comfort in shooting, but have little effect on the location of the impact of the shot relative to the dot.

Length of pull

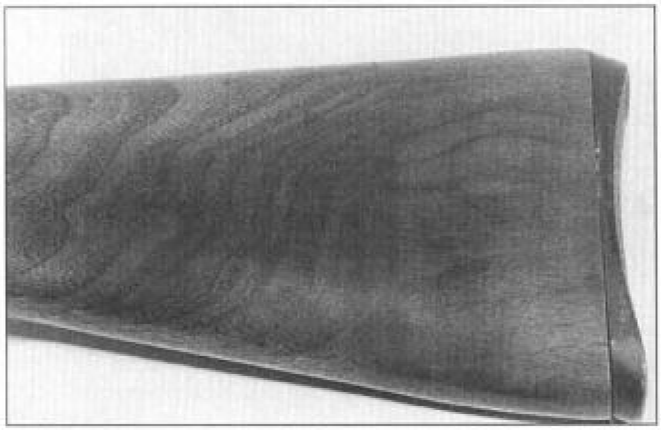
Length is the easiest dimension of a stock to measure, and probably the one that matters the least. Changes in stock length do not correspond to the Churchill 1:1/16 ratio. So long as you can get the stock up without snagging your clothes, it is short enough. If it keeps your thumb from bumping your nose, it is long enough. Somewhere in the middle there is a length right for you, but that “right” length can span more than an inch of different stock lengths. Shotgun stocks are too long for many shooters. A longer stock feels good at the gun shop, and the proportions look right. Get out in the duck blind with layers of wool and wind-proof synthetic on, and that stock will be at least an inch longer than it was in the gun shop. A stock that is too long makes it harder to reach the trigger and forearm, makes mounting it to

your shoulder clumsier, and moves your eye farther down the stock. Not only is the shotgun harder to use, but with your eye farther back, the gun will now deliver its pattern to a different spot than it did when you tested in shirtsleeves. When you practiced at the range, you wore a shirt, or a lightly-padded shooting jacket. With all the winter clothes on, you aren't hitting where you were then. It may not make much of a difference, but all the small changes add up. Test it as you will use it. If you are going to use your shotgun bundled up like and Eskimo, then that is how you should fit-test it.

Bring the gun up and fire without aiming. You want the gun to feel good, but not spend time guiding the bead.

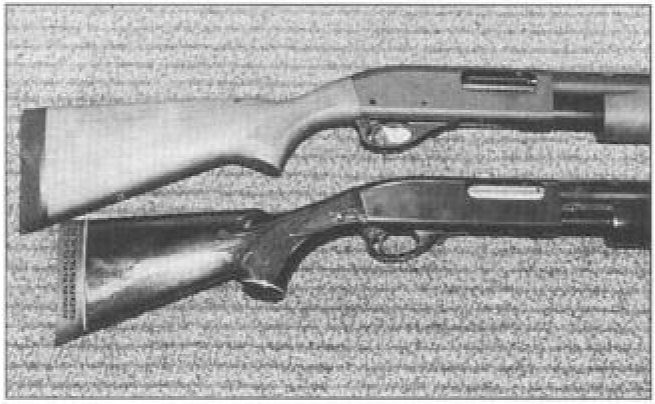
To shorten a too-long stock requires the right equipment. You have to cut the stock the amount you want without chipping the wood, and re-fit either the old pad or a new one. At the very least you need a belt sander or a disk sander secured to a bench. A radial or table saw with a carbide-tipped blade is a big help. If you don't have either, or access to them, then shortening a stock will be an ordeal. (Sorry, but there is no way to sugar-coat it.) Shortening your stock may be something you want to take to a professional gunsmith. Shortening a synthetic stock is sometimes not possible at all. Many synthetic stocks are hollow, with the recoil pad screws fastened to threaded metal inserts in the plastic. If you cut the plastic, you cut off the inserts, and now have no place to attach the recoil pad to. The Remington 1100 is another troublesome stock. The recoil spring tube and its nut are

close to the end of the stock. You can't shorten the wood so much that the tube sticks out. For those who wish to forge on with their wood stocks, and those curious as to how it is done, here goes:



***A stock that has been shortened can be made long again by attaching new wood to it. If you can, save the old, cut-off piece, as the grain will match better than this*.**

Remove the pad or buttplate. If you are going to shorten your stock but retain the same thickness pad, you mark the stock for the amount you will shorten it. If you are going to shorten your stock while at the same time adding a thicker pad, you have to mark the stock a distance equal to the amount you want the stock shorter, plus the difference between the two pads. As an example, if you want to shorten a stock by an inch but retain the same ¼-inch-thick pad, mark the stock one inch shorter. If you want the stock to be an inch shorter after you have added a 1-inch pad, mark the stock an 1-¾ inches shorter. (One inch shorter, plus the ¾-inch difference between the old pad and new.) Stand the shotgun on the floor or bench with the top of the receiver touching the wall. If you want to keep the same pitch in your stock, then you will mark the stock parallel to the floor or bench. Place a strip of masking tape along the stock parallel to the floor, along the amount you want to remove. With a ruler, measure the distance you want cut and mark the tape at the heel and toe. While you have the shotgun standing up, measure the distance of the muzzle from the wall. Save the measurement, as it is your pitch check.



Youth model shotguns like the lower 870 commonly have shorter stocks than standard shotguns.

Take the stock off the receiver and with a straightedge draw a line between the two marks. Draw first with pencil, and then with a felt-tip marker. A moment here for pad dimensions. Your pad should follow the contours of the stock. The farther back it goes, the larger the pad must get. To determine the dimensions of a pad can be very easy. If you are shortening a stock by 1 inch to install a 1-inch pad, then the new pad must be slightly larger (butt to heel dimension) than the wood you are removing. If you are shortening a stock more than the pad thickness (taking 2 inches of wood off and placing a 1-inch pad on, for example) then measure the stock at the line where the new pad will be, and use that as your pad dimension.

In any case, you don't want a pad smaller than the stock. However, if you order a pad too large, you may have other troubles. If the pad is solid, you'll be forever (and knee-deep in rubber grindings) trimming the pad down. Pachmayr Decelerator pads are hollow inside. If you start with one that is too large, by the time you grind it down the hollow may be so large that the side walls of pad offer no support. Every time you fire it, the walls quickly collapse and offer little in the way of padding. Properly fitted, the Decelerator is one of the softest pads around. Improperly fitted, any pad can bring tears to your eyes when you shoot. When you order your pad from Brownells, order one just larger than the width and height of your stock.

With the recoil pads flat and the receivers touching the wall, you can see the difference in pitch between these two guns.

Most of the time, when you shorten a stock, the old pad becomes useless. Rarely will you be able to re-install the old pad, unless you are shortening a stock only ¼ inch or so. As the stock gets shorter, the bottom edge (the toe) gets closer to the top (the heel), yet the screw spacing on the old pad does not change. If you shorten the stock an inch or more, the old screw hole ends up too close to the toe. A screw hole too close to the toe is an invitation for the wood to chip if it is set down too hard. Also, when you drill the hole deeper for the screw to be re-inserted, you may drill out through the belly of the stock. You cannot relocate the screw in the pad.

To cut the wood you need one of the following: a fine-tooth saw and a miter box wide enough to accommodate the stock; a radial-arm saw with a

carbide-tipped blade; or a table saw with the same kind of blade. You do not want to be using a regular carpenter's saw. The carpenter's saw will probably chip the edges of the stock, making your job more difficult.

With the miter box, adjust the stop so the line falls right under the blade. Check the fit of the stock in the box. You want to he able to clamp the stock in place on each side, and cut right on the line. Clamp the stock in the box, and saw with just enough force to cut the wood, but not so much you splinter the edges of the cut. Once you have cut through the side of the stock top to bottom, turn the stock over and start cutting from the other side. Wood is less likely to splinter if you cut down into it than down out of it. Splintered edges are very difficult to repair, and you are better off spending time avoiding them than spending time fixing them.

The power saws make the job much easier. With a high rpm and slow feed, the carbide tipped blade will cut cleanly enough that you won't have to sand, and they will not chip the wood.

After cutting, reinstall the stock on the receiver and check pitch. If the pitch has changed, you will have to re-cut the stock to get the pitch right.

Remove the stock from the receiver and clamp it in a padded vise. Use a straightedge to draw a pencil line down the centerline of the butt. On the back of the Pachmayr pad container you'll see the hole spacing and pad dimensions. Take the distance from the top of the pad to the top screw hole, subtract .150″ and draw a line across your centerline. Measure down the distance between the screws and mark another crossline. By subtracting .150″ you ensure that the pad will be higher than the heel and give you pad to remove and blend with the stock. Starting with these rough measurements, we will establish the exact centerline of the stock. Measure the width of the stock along each screw location line. Divide the measurement by two, and measure and mark your centered screw location.

Sometimes you can use the old heel screw location to secure your new pad. Rarely can you use the old toe location. For both screws, check the newly measured location to the old screw hole. When you drill your new screw holes, the wood that remains between the holes must be greater than the hole diameter. If there is not enough wood you must plug the old holes before you can drill the new ones. Drill the old hole out with a ¼-inch drill bit. Mix up some Brownells Acra 20, and smear it on the hole and plug. The plug can be a dowel from the hardware store, or a cut-down duck plug from a Mossberg 500. In the gunshop, we used to sell a large number of

Mossberg shotguns for defense use. The last thing someone buying an eight-shot shotgun needs or wants is a duck plug. I ended up with a drawer full of them, and used them for plugging stock holes under pads. Press the dowel into place and tap it home with a hammer. Leave the stock clamped vertically until the epoxy has set.

Once set, cut the dowel as flush as you can and sand the stock smooth. If you haven't already, remove the masking tape. Use a compatible stock finish to seal the end of the wood. If you don't seal the stock, the edges of your stock will gradually warp from the moisture that enters from the bare surface.

Drill your new pad holes. To cut the pad for the screws, press a drift punch into the screw hole from the back side, and use a razor blade to slit the pad. Place a drop of synthetic lubricant on the slit and press the screw through. Rub the threads of the screw with bar soap. Wipe a little of the same synthetic lubricant on your screwdriver blade and turn the screws tight into the stock. You've finished the clean part.

Place three layers of masking tape on the stock flush with the pad. Use a felt-tip marker to draw a zig-zag pattern on the top layer of tape. To grind the pad flush you'll need a belt or disk sander. For your own protection you'll need glasses or goggles, a breathing mask, hearing protection and a bright light. The rest of the room would benefit from a Shop-Vac and drop cloths. Spread the cloths over your bench, gun rack, shelves and anything else that would be a hassle to vacuum. If you can, attach the Shop-Vac to the sander. Stand the light over the grinder or sander so you will have a good view of the work.

Pad grinding is noisy, messy, smelly work that you must do perfectly. You do not want to be interrupted while grinding. If you approach the task with a heavy hand you can “kiss” the stock with the sanding belt, and spend a couple of hours touching up the wood you marked. Even if you are installing a pad in an unfinished stock, hitting the stock with the belt can create marks that you'll spend extra time sanding out. Be patient. Stand to the side of the belt sander, with the light on the other side. Hold the stock by the pistol grip and near the pad. While holding the near surface of the stock parallel to the running belt, press the pad against the belt. To prevent flat spots, roll the pad against the belt, following the curve of the side of the stock. You do not want to press too hard, as you will heat the pad and the belt might slip. Gradually grind down the pad, following the curve of the

stock, until you are scuffing the top layer of masking tape. Once the top layer is evenly scuffed, remove it. Mark the second layer with the felt tip pen and sand until it is scuffed. Repeat on the third layer.

With the sides sanded down, place a strip of tape over each of the heel and toe and blend them into the curve of the sides.

Turn off the belt sander. Clean up the shop. Sweep and vacuum the floors, take the drop cloths out and shake them off, brush off your clothes and maybe even take a shower. When doing pads commercially, I preferred to do them one day a week, and wait until after lunch. I would prep all the pad jobs ahead of time, and then spend an afternoon grinding. That way I had to put up with rubber dust one afternoon a week, instead of several days a week during the busy season.

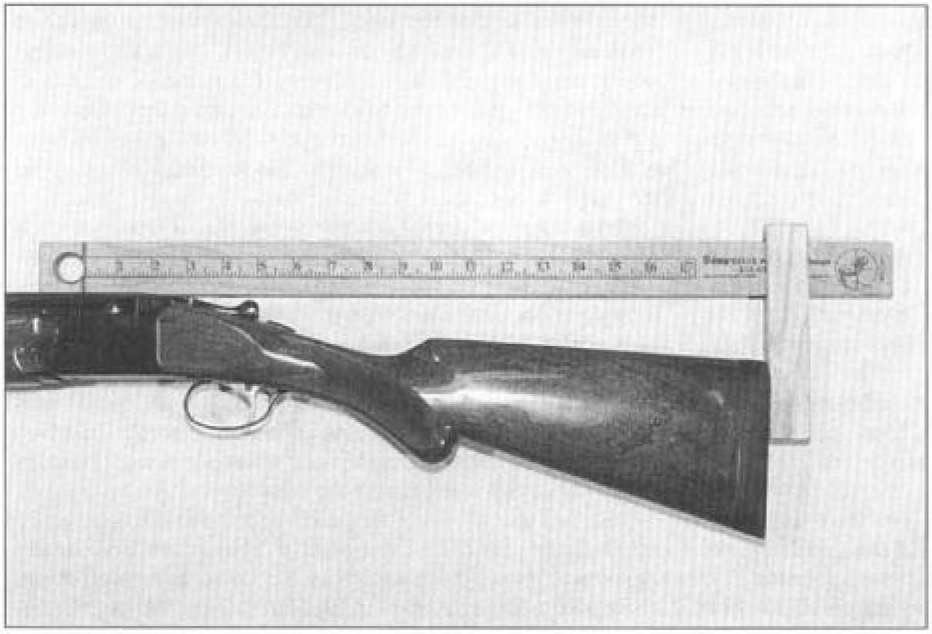
The last part of fitting the pad is to remove the belt sander marks from the pad. Even with a light touch and steady movement, you'll have flat spots. Sit down in a comfortable chair with a large second cut file. Hold the stock in your lap (you'll definitely want an apron on for this) with your left hand. Place your thumb against the stock at the edge of the pad. Place the safe edge of the file against your thumb, and using your thumb as a stop, file the pad smooth. Once smooth and blended all around, a fingertip's worth of linseed oil will darken and even the appearance of the pad edge. If you are using a Kick Eeze sorbothane pad and want the bright synthetic look, then don't apply the linseed oil.

If you scratch your stock, or want to refinish it, you may need stock stains. With them you can make the scratch color match the rest. If refinishing, you can make the stock look the way you want it to.

Reinstall the stock on the receiver. If you have to remove the pad to reinstall the stock, shift the pad around until it is flush all around when you tighten it. The screw holes in the pad have enough room in them that the pad might shift a little bit when tightening, and you want it perfect.

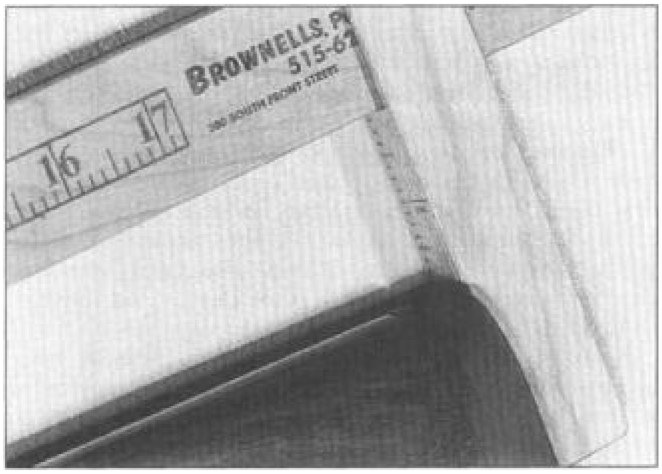
The location of the cheekpiece determines where the pattern hits. Rarely will you be faced with the problem of the cheekpiece being too high. I ran into it a few times, and in all cases the shooter had a large, round face. The size and shape of their face positioned the stock too far away from and down from their eye, and they could not squeeze in tight enough to see the bead properly. The patterns would strike high of the mark. Sometimes too high even for a trap gun.

Even if you do not mar your stock installing a recoil pad, keeping it looking good when you use it may take some effort. The only other choice is to not use the gun. What good is that?



Drop is the distance between the top of the stock and the line of the rib or bore. The rib is easier to measure, but you can calculate the bore-drop by measuring from the rib to the chamber center.

To tell if you see the bead properly, we have to define “proper.” Proper is a repeatable view of the bead, where the bead gives you a predictable location for the pattern. Proper view depends on pattern impact, and to pattern your shotgun you'll have to go to Chapter Six. Take the empty shotgun and place the buttplate to your shoulder in your shooting position. Look down the rib or barrel. Do you see just the bead, sitting on top of the visual image of the receiver? Good. Is the bead straight down the center of the rib or barrel? Also good. If you see large amounts of the rib or barrel, or your view to the bead is not down the centerline, your cheek-piece may be too high or thick. Since we are not interested in surgically altering your face, we have to change the stock.



We can see here that this stock has 1-¾ inches of drop, a straight stock by many standards. Half a century ago, many stocks would have had more than 2-½ inches of drop.

Trap is more of un aiming game than other shotgun games are. However, given a comb that is too high (or a face that is too round) we would also see the patterns striking the pattern board too high on the Churchill method.

Before you go altering your handsome stock, practice on another. I have worked on a large number of Mossberg shotguns through the years. Partly because they are quite popular in Michigan, and could be obtained cheaply. Also, spare parts are easy to obtain, so if I screwed up a part I could quickly replace it. To alter your stock you'll need cabinet makers pattern rasps from Brownells, sandpaper and stock finish that matches the current finish and a china pencil. Place the shotgun to your shoulder and hold it there with your left hand. With your right hand reach up with the china pencil and mark the comb just in front of and behind your cheek. With the rasp start removing wood from the comb between the china pencil marks. Periodically check your progress by looking at the bead. Stop when you can comfortably get your face to the centerline of the bore. Your stock will have a dished section in the comb. Blend the top of the comb over into a smooth curve. If you leave a sharp edge, it will come up during recoil and gouge your cheekbone. Rasp forward from the dished section to blend the contours of the stock. Again, if you leave the forward part of the dished section in place, it can strike your cheekbone during recoil. Sand the rasped area smooth and refinish.

Many shooters will have the opposite problem, that is the stock is too low, and they cannot get support for their face. A low comb is a particular

problem when putting a rifled barrel on a shotgun for slug shooting. The iron sights are always higher than the bead, and a scope is higher yet. If you try to aim with your cheek off the stock, you make the job harder, and you let the stock get a running start before it hits your face.

The easiest way to build up a comb is to add a pad. While temporary, even a “temporary” fix can work for years. Brownells carries two different rubber cheekpiece pads, called “Cheekeeze” and “Cheek-Eez.” Available in different thicknesses, it is a simple matter to peel the backing off and apply a pad to your stock. But how thick? The Churchill method will give you a starting point. Once on, the pad is messy to remove. If you guess wrong on the thickness, you may be in for a lot of work. Instead of using the difficult-to-remove rubber pad, use the widest masking tape you can find. At the range, apply layers of masking tape to the thickness the Churchill method indicates. To determine the proper number of layers of tape, use your dial calipers to measure the thickness of a card. Apply the tape to the card until it reaches the proper thickness you need. Count the layers of tape, and apply that many to your stock. Pattern test it. Then shoot your shotgun on clay pigeons and see if you notice an improvement. You should, as the stock is better-dimensioned for you. Since the pad will compress when your face is pressed against it where the tape did not, you should get the next thicker rubber pad to put on your shotgun.

Strip the tape off your stock and clean the cheek and comb with rubbing alcohol to get the old adhesive and general dirt and oil off the stock. Press the new pad against the stock and smooth it out.

The Sorbothane recoil pad and rubber cheek-piece on this 12-gauge help to tame the recoil and make shooting more fun.

Checkering is a pattern of grooves cut into the wood to give a surer gripping surface. By crossing another pattern of grooves over the first, you create diamonds or pyramids in the wood. Well-done checkering enhances the appearance and utility of a stock. Over time, the wood can become worn, reducing the grip of the checkering, or the grooves can be filled with dirt and old stock finish. The dirt can be scrubbed out, but worn checkering, or grooves filled with stock finish have to be re-checkered.

Checkering tools come in two types, guided and unguided. The guided tools use the groove next to the one you are filing as the guide, keeping your lines parallel. Unguided tools do not use an adjacent groove, and are used to cut into corners and borders, and to start that first groove.

One type of unguided checkering tool is the Jointer. You use it on a new job to re-straighten a line that has started to wander because of the grain of the wood, a change in humidity, or the price of e-stocks in Singapore. You also use it to establish your lines across a stock repair that went through a checkered section. Another unguided tool is a bent needle file. The curved file lets you focus your efforts on a short section of your diamonds.

The guided tools use a dual head and a split rod from the handle. The dual head has one cutting section and one non-cutting section. The non-cutting section rides in the adjacent groove, guiding the cutter. The split rod gives

you a view of your progress without having to peer around the tool itself. The checkering tool heads are replaceable, so you can go to a cutting head of any line spacing you need or want. You can also get an unguided single-edge cutter for cutting right into the corners or edges of your pattern.

A great aid to checkering is a checkering cradle. With only two hands, trying to hold the stock and checker it is impossible. A padded vise may cover the area you want to checker, and even if it doesn't, the stock will not rest at an angle comfortable to checkering. A good cradle will hold the stock and be out of the way, and let you adjust the stock to sit at any angle so you can comfortably wield the files and cutters.

To re-cut your checkering you first have to determine the line spacing. Checkering is referred to as “X” lines per inch. The more lines the finer the checkering. You cannot cut checkering finer than the grain structure and hardness of the wood will allow. While metal checkering of 20 line per inch is coarse and 30 is medium, in wood 20 lines per inch is fine. To measure your current checkering you need to either get out a dial caliper or use the Brownells Chekrchex. The clear plastic of the guide has lines in different spacings printed on it. Place the Chekrchex over your checkering and see which pattern lines up best with yours. You'll need a checkering head of that spacing to re-cut your checkering. If you are re-cutting checkering that is worn or filled with stock finish, you will have to establish a starting line. Look over your checkering and find the line that is the cleanest and sharpest, and extends the full length of the checkering panel.

Take your curved needle file and carefully clean the guide line out. Keep your file perpendicular to the stock surface, so you cut both sides of the groove. With one guide line cut, adjust the stock or yourself to line up with the cross lines. File a guide line in the cross pattern. Once the two guide lines are cut, switch to the dual head cutting tool. Put the guide side in the initial groove, and use that groove to guide you while you cut the next one. Repeat with each groove. If you have started in the middle, turn the stock around and cut the rest of the grooves in the other direction. Once you have finished one set, then use the second guide line to cut the cross lines.

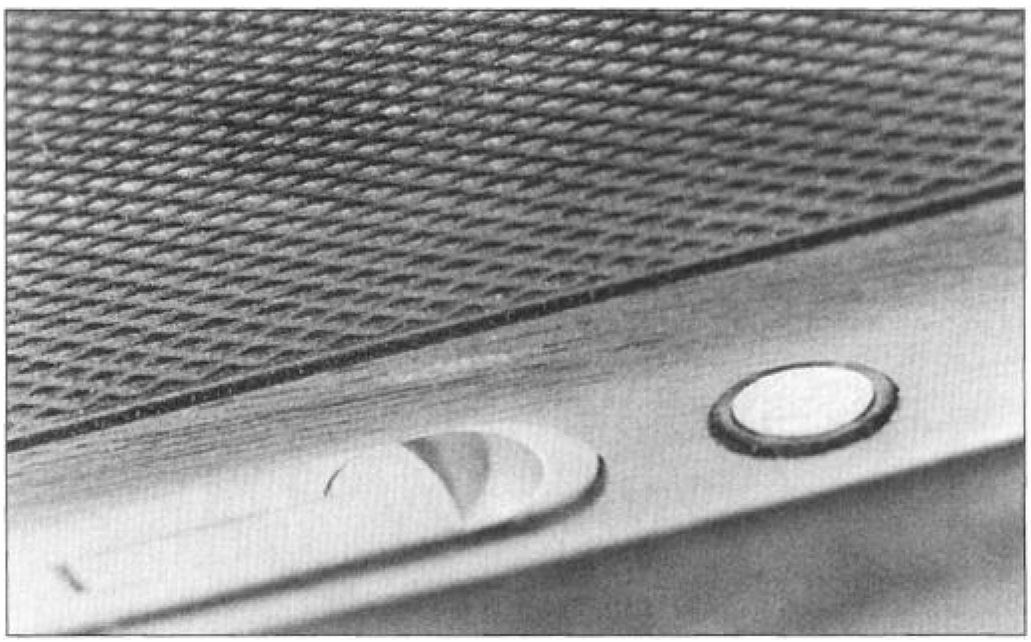
With the checkering recut, look over the diamonds. If any are not even or sharply pointed, use the bent needle file to adjust those particular diamonds.

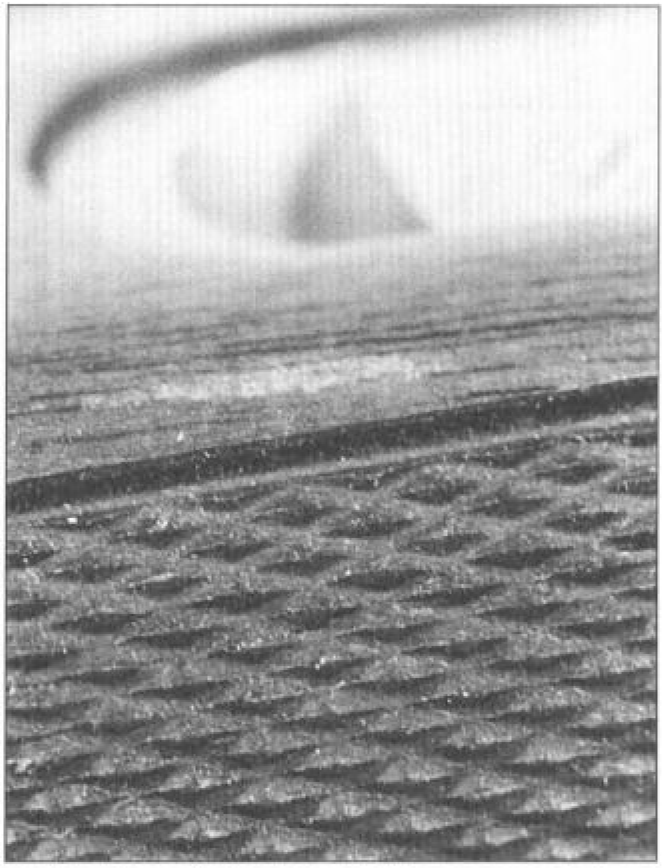
Brush the checkering out with a clean dry brush, and then apply a light coat of stock finish to seal the wood.

Checkering

The traditional method of cutting checkering is with the same hand tools we just used to recut checkering. Many stocks were checkered over a long period of time by just this method. Starting with a layout pattern, the first line would be filed into the stock by hand. Then the pattern would be filled out by hand-filing each groove with the guided head. Time and labor-intensive, it cost so much that many factories had switch to impressed patterns. Instead of cutting the pattern, the factories would use large hydraulic machines to press the pattern into the wood.

Checkering is created by cutting parallel lines in the wood, creating a checkerboard of sharp diamonds.





***As a means of making the job easier, checkering has a border. The border allows each line to end in space, and not in wood. Some say a border hules mistakes, but most people would be unwilling to pay for perfect, borderless checkering*.**

The development of portable and handy-to-use power cutters led the way back to cut checkering. With the addition of carbide cutting blades, cut checkering suddenly reappeared on factory shotguns.

The cutting tool tike the one offered by Brownells is a pencil-sized head with a rotary blade in it. Attached to the motor with a flexible shaft, the cutting tool can be maneuvered around to any cutting angle. With the foot-operated rheostat you can rev the cutting blade up whenever you need to.

With the power checkering tool, the job is a snap. First, either select a checkering pattern from one of the Brownells decals, or design your own. With the Brownells decal, attach the decal to the stock. If you are going to do your own design, you have to draw the design on the stock. With the stock in the checkering cradle and decal or drawing in place, put on your glasses, muffs and mask. Take a piece of practice wood and use it to adjust

the spacing on your cutting head. Cut four or five lines and compare their spacing to the Chekrchex. Adjust the cutting head until the practice lines have the spacing you want. Then, switch to the decal. Carefully cut your guide lines. Then use the guide lines as you did in the re-cutting section, and fill out the rest of the pattern. The wheel radius will keep you from cutting right to the border. Once you have the pattern filled, turn off the power and go to hand tools. Use the single-edge cutting head on your checkering tool to bring the ends of the line right into the border.

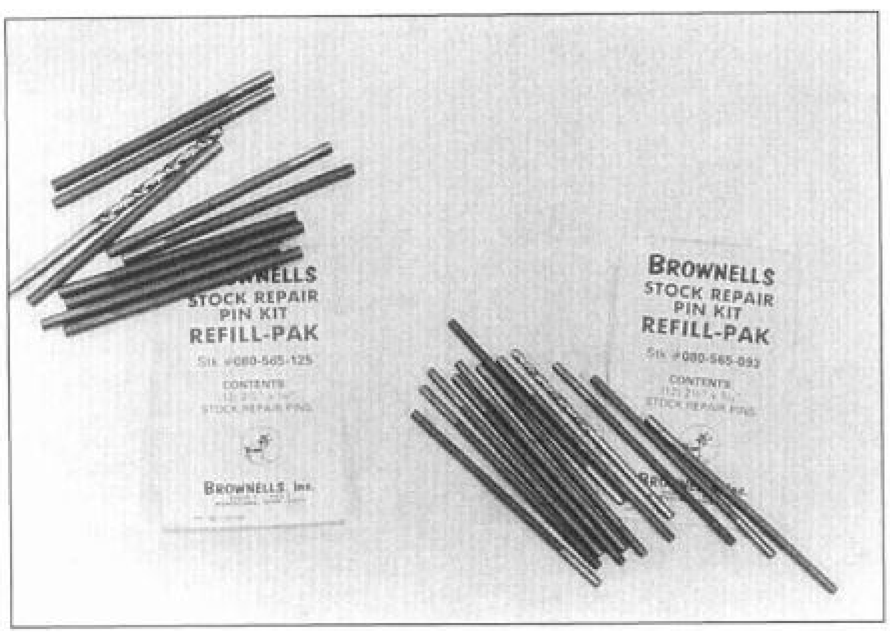
Having someone else cut your checkering can be expensive. Doing it yourself can be time consuming. If you have a hand and eye for patient detail, and are willing to make the modest investment, you can do a stock in an evening. I know of shooters who had retired from work and the inactivity was driving them crazy. With a power cutter they can keep busy and make money cutting checkering.

Repairs

Wood is light, strong, durable and beautiful. It also is fragile, expensive and difficult to maintain. A stock that gets taken out for hunting or range practice runs the risk of getting dinged, dented, scratched and cracked. Repairs use to be difficult and uncertain of success. With the invention of epoxies, any stock can be repaired

Brownells offers surgical rubber tubing to clamp epoxy wood repairs. The epoxy will not stick to the rubber.

Stocks usually crack in the front or back. The front cracks from recoil or hard handling, and the rear cracks from hard impacts on rocks, boat rails and decks, blind lumber and car doors.



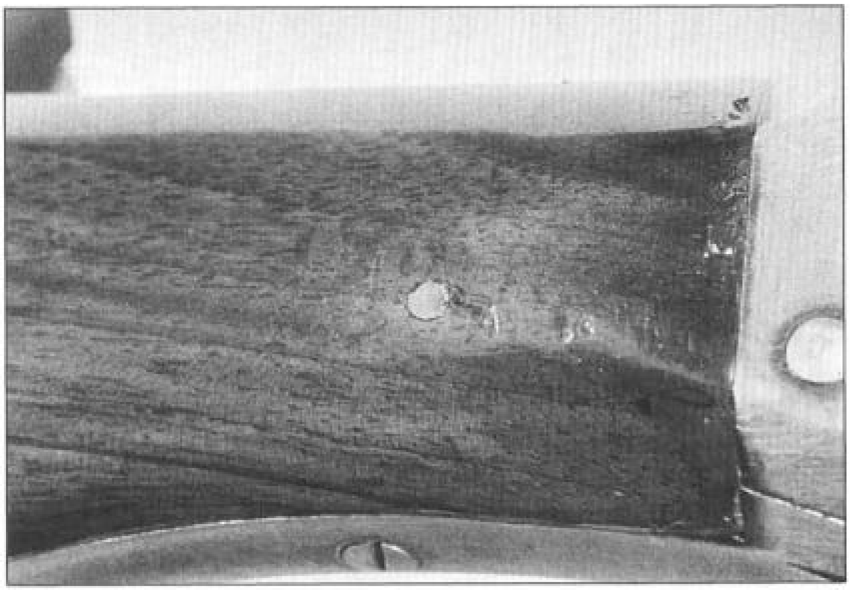
To hold together pieces, or reinforce a weak area, you can use these threaded brass pins.

Unlike rifles, the forearm on an auto-loading shotguns is a hollow shell that is unsupported by the tube it encloses. Lever-action rifles have forearms around a magazine tube as shotguns do. But the wood fits tightly around the tube of the rifle, while on the shotgun the forearm has to have internal clearance for the moving parts.

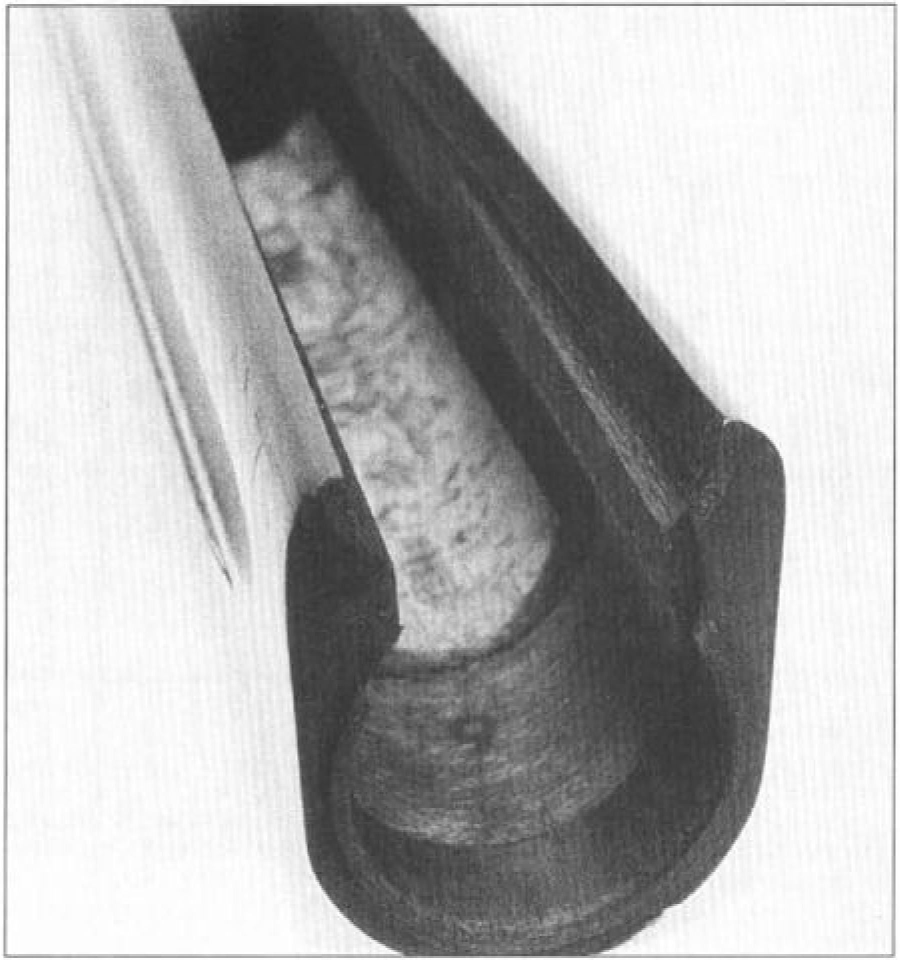
On a pump shotgun the forearm is clamped between the front and rear retainers and tightly fits the action tube.

But on autos, especially the Remington 1100 and the Browning A-5 and its clones, the forearm is a shell. While reasonably durable on the gun, either forearm can be crushed with your bare hands when it is off the gun. When you disassemble these models, be careful to place the forearm where it can't be damaged.

Forearm cracks appear in one of two places, front or rear. I have only seen one Remington 1100 forearm cracked at the front. The shotgun it was on had been placed on top of the car at the end of the day's hunting, while the owner packed his other gear in the trunk. He forgot about the shotgun (!!??) and drove off. His first clue was the clatter on top when he hit a rut, and the brief view of “something falling past the window.” The cracked forearm was the least of his problems, and we replaced the forearm rather than try to repair it. The Remington 1100 forearm does not act as a structural member, so you could repair a front crack in the same manner as repairing a cracked tang. Drill into the crack from the front, along the line of the crack and as deep as the drill will go. Keep the bit parallel to the sides so it does not break out of the forearm. Mix a runny epoxy mixture like the original Acra Glas, and stand the forearm up on end. Drip the epoxy into the hole until the hole is full. Spray release agent on your magazine tube and slide the forearm over the tube. Put large rubber bands or surgical rubber tubing around the forearm to compress it. Once the epoxy sets, slide the forearm off the magazine tube, clean the excess off the face of the forearm and reinstall it.



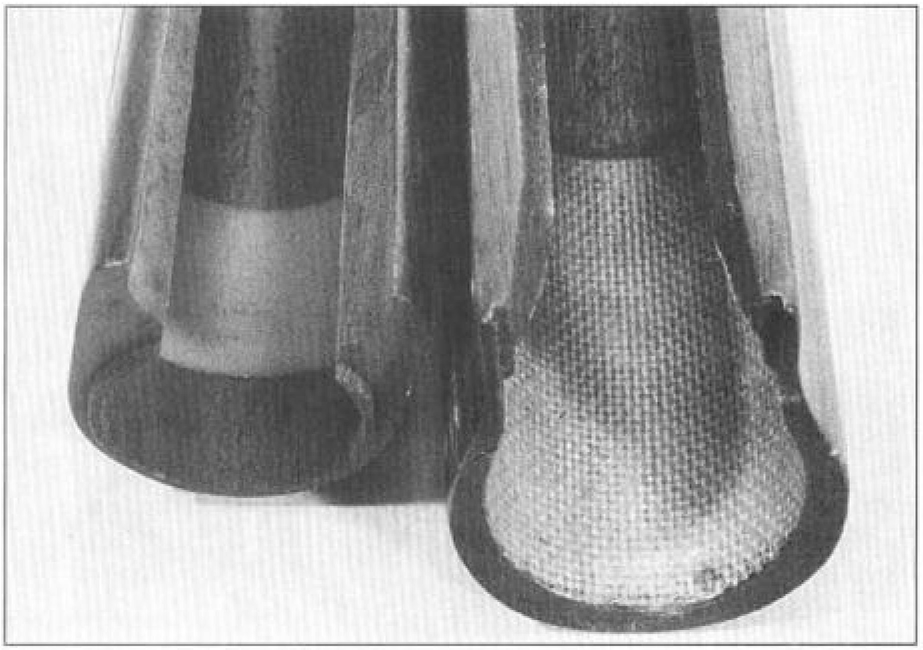
This cracked stock has been repaired and reinforced with a brass pin.



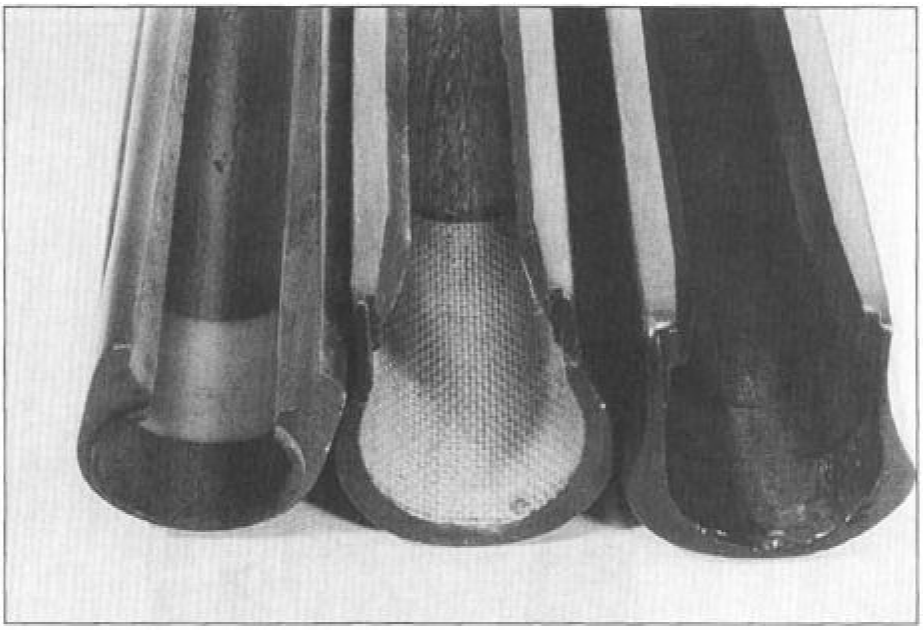
While relatively robust while on a shotgun, forearms are simply wooden shells. Once removed from the gun, they can easily be cracked or broken if mistreated.

The Browning forearm is a structural part of the action. The forearm takes the full-force hit of the barrel when it closes. I have seen more Browning forearms cracked in front than I have seen Remington 1100 forearms cracked in the same area, and usually this is because the owner left the end cap loose. Proper positioning and tightness of the Browning forearm is essential to proper function and durability. If you keep the magazine cap finger tight against the forearm (check when the barrel is slightly retracted, not when the barrel is forward) and the rear of the forearm in its receiver groove, the forearm will not crack at the front.

Forearms are just wooden shells, especially on autos. Take care when they are off the gun as they are fragile and will break quite easily.



Browning forearms cracked at the front cannot be repaired. The crack is created by such a sudden shock, and is so severe, that simply applying epoxy to the crack and clamping it together is not enough to hold. You can wrap the forearm in fiberglass to reinforce it (I did that as an experiment) and the repair will hold. But it will set new records for your area in the "ugly gun" competition. A Browning forearm with more than a hairline crack at the front should be replaced.

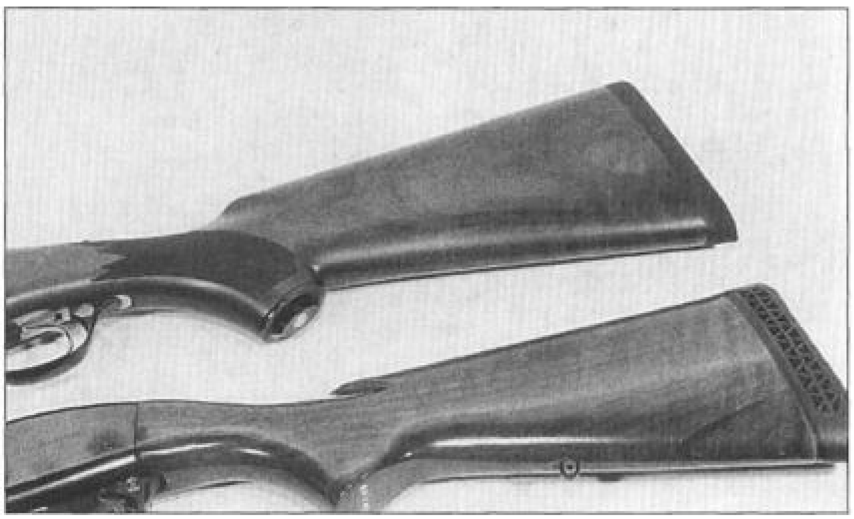


***Early shotguns did not have reinforced forearms. Later, the factory added synthetics to strengthen them. Left to right, the newer Browning has a molded ring epoxied in place and the Remington has a layer of fiberglass cloth epoxied in. The right-hand forearm has a reinforcing ring of fiberglass cloth epoxied in place after it left the factory*.**

Both the Remington 1100 and the Browning A-5 forearms commonly crack at the rear. A crack can be annoying, as your fingers run across it when handling the shotgun. It can he distracting, if one of your fingers gets pinched as the wood flexes. And it can be dangerous, if the crack extends enough to get slivers in your hand. It is also a tough one to repair. The thin wood shell does not respond to merely filling the crack with epoxy. You'll start there, but have to go farther. To repair a cracked forearm, you'll need epoxy, a piece of masking tape, your hand-held grinder with a coarse sanding drum, and a piece of fiberglas reinforcing cloth. First, you want to stabilize and properly position the forearm. Mix up a small amount of epoxy and, with a wire, run it along the length of the crack, inside and out. Gently flex the cracked parts of the forearm to work the epoxy into the crack. Use the tape to hold the forearm together and keep the edges lined up. Since the forearm is a hollow shell and unsupported at the top, you can't clamp it or compress it with the tubing, hence the tape.

Once the epoxy has set, get out your hand-held grinder with its sanding drum. Put on safety glasses, hearing protection and a breathing mask. Sand a groove inside the forearm, directly across the crack and perpendicular to

the line of the bore. The groove should be the size of the sanding drum, at least half an inch in from the rear edge of the forearm, and just deeper than the thickness of the fiberglass reinforcing cloth. The groove should go from 4 o'clock to 8 o'clock along the inside of the forearm. With a pair of scissors, cut a strip of the cloth to fit it into the groove you have sanded. Mix up your epoxy and place a small line of it along the groove. Press the cloth into the groove and then ladle the rest of the epoxy in on the cloth. The cloth will soak up the epoxy. Apply epoxy and press it into the cloth until the cloth has soaked up as much as it can. Leave a film of epoxy on top of the cloth. Let the epoxy set.



Some shooters think sling swivels are ugly, but if you've ever carried a shotgun any distance, you'll appreciate a sling.

The next day or week, put your protective gear back on and use the hand-held grinder with the sanding drum to smooth the edges of the hardened epoxy/cloth mixture. Once you are done smoothing the surface and making sure the internals of the action will not catch, clean up. Ground fiberglass cloth is nasty, and you do not want to breathe it. Keep your mask on. Wipe up the ground powder with a damp paper towel and dispose of it. Also pitch your breathing mask. Once the shop is cleaned up, throw your clothes in the wash and take a shower. Be sure to shampoo. These precautions may seem extreme, but the glass particles created by grinding are small, and can easily

get into your lungs. Prolonged breathing of fine powders can cause health problems.

***Both Pachmayr and Millett have made flush-mount sling swivels*.**

Once you are done cleaning, then smooth the epoxy that oozed out on the length of the crack and spot finish the forearm inside and out.

Swivels

Some shooters feel that sling swivels have no place on a fine shotgun. I would think that having spent many thousands of dollars on a custom shotgun (some can go for more than mere thousands) any owner would be loathe to put it on the ground. And just how are you going to carry your

decoys, camp stool and cooler out to the blind and hang onto your shotgun with no sling swivels?

Considering the unsurpassed ugliness of some of the sling swivel installations I have seen, I can understand some people's reluctance. But a sling swivel installation does not have to be ugly. Sling swivels come in three types, non-detachable, detachable and flush mount. The non-detachable sling swivel units have faded into historical curiosities. While non-detachable slings swivels used to be the norm, the popularity of detachable units has reduced them to the point that there are none listed in the latest Brownells catalog.

In detachable slings, there is the Uncle Mikes system. I'm sure in the beginning Uncle Mikes had competitors, but they melted away under the persistence of the green machine. The Uncle Mikes system is very simple, the sling swivel stud is a threaded post with a lateral hole in the top. The stud attaches to the stock and stays in place. The sling swivels clip on or off the stud.

The flush-mount sling system is currently available from Millett. The flush system uses a hollow post with a slot in the stop and a spring inside of it. The sling swivel is a loop with a “T” post on it. To install the sling, you push the “T” into the slot, press against the spring, and turn the loop a quarter-turn.

When the sling is off of the shotgun with the Uncle Mikes system, the stud is small but unobtrusive. With the Millett flush-mount the installed parts are level with the wood.

To install a sling system on your shotgun you have to have two sling swivel points. The rear one is easy, place it 3 or 4 inches from the buttplate or recoil pad. You'll need the sling swivels, a drill, a countersink for the Uncle Mikes, some soap, and with the Uncle Mikes you want a tap. Available from B-Square, the stud tap cuts the threads in the wood for your sling swivel stud, and makes screwing it into place much easier. With either system you should obtain a drilling guide. The drilling guide for the Uncle Mikes system is available from B-Square, the Millett system from Millett. Place your unloaded shotgun either in a padded vise or in a cleaning cradle, upside down. Take the drill guide and place it on the buttstock. Slide it back and forth until you have the hole 3 to 4 inches from the end of the wood. If you get it too close you increase the chances of chipping the toe of the stock under hard use. By keeping the stud more than 3 inches from the rear, you

also eliminate the chances of running into the bottom screw of the buttplate or recoil pad. If you get it too high it just looks a little strange. On defense shotguns, some shooters prefer to put the rear sling swivel stud in the bottom of the pistol grip. One method of carry is with the muzzle down. If you have a shotgun on your shoulder in muzzle-down carry and have to kneel, you can put the muzzle into the dirt with a standard sling swivel location. The grip-mounted sling swivel makes the shotgun ride enough higher on your shoulder that the muzzle clears the ground when you kneel.

Before you put the bit in the drill, put it in the hole in the guide. Check the alignment of the drill to the centerline of the shotgun. By standing back and sighting down the length of the gun you can tell if the drill is vertical to the centerline or not. Adjust it until it is. Use masking tape to hold the drill guide in place. Take the dill out of the guide and chuck it in your drill. Drill the hole slightly longer than the threaded length of the stud. Remove the drill and the drill guide. If you are using the Uncle Mikes system, install the countersink and run it down the hole. Cut a flat on the stock just large enough to settle the base of the sling stud against. Take the tap and turn it into the hole until the tap shoulder contacts the stock. Having used the tap, it is easy to turn the stud in place. Select a drift punch that will just barely fit and stick it through the hole. Use the punch as a lever to screw the stud in place. If you have not used the tap, rub a little soap on the threads of the stud. The soap will lubricate the threads and let you screw the stud in place.

One convenient location for the forward sting swivel is on the magazine cap.

Once the stud contacts the wood, turn it until the hole is perpendicular to the line of the bore.

With the Millett flush mount, the procedure is much the same. Position and line the hole up, and drill it. You don't need a counterbore. The Millett comes in two types, the glue-in and the threaded. The glue-in needs epoxy to hold it in place. The threaded one simply screws into the stock until it is flush and the slot is lined up with the axis of the bore.

But where to put the front one? The forearm as a suitable location is out in every case. On pumps and autos, the forearm is too thin to support the sling stud. Not that it can't be done, but it isn't easy, risks breaking the forearm, and hardly worth the effort. I installed a set of sling swivels on my Remington M-11 that I built up for practical shotgun competition. I used a Talley sling swivel base, that is inlet into the wood and held in place with two screws. I inlet it into the thicker part of the wood, ahead of the barrel stop shoulder. Not only did I use the two screws (shortened to clear the magazine tube) but I epoxied the base into place. The same method would work with other autos, but I don't recommend it. The wood is too thin, and the cutting and the stud can create stresses leading to forearm breakage.

On many shotguns the front sling swivel should go in the magazine cap. The common models that receive the magazine cap treatment are the Remington 870 and the 1100 or 11–87. Some shotguns do not have to have the end cap drilled for a sling swivel, usually because they lack a removable end cap. The Mossberg 500 and the Ithaca M-7 are simple front sling swivel jobs. Both have their barrel hanger drilled and tapped for a sling swivel. Once you have the correct sling swivel kit in hand, the only trick is using a drop of thread locking compound to make sure the stud doesn't unscrew on you.

Installing the front sling swivel stud on the Remingtons is easy with a lathe, and a pain without. Uncle Mikes makes a front sling swivel installation that goes into your magazine cap. Current production Remington 870s have a hole through the cap that you can use as a drilling guide. Older ones, and 1100s and 11/87s did not. With a lathe, wrap a couple of layers of masking tape around the cap. Chuck the cap in the lathe with the top of the cap inside the chuck and with the bearing shoulder tight against the face of the chuck. In the tailstock, chuck a 5/16-inch drill. Turn on the lathe and drill the center of the cap out.

Without a lathe, you need a drill press. On the drill press, again take the tape-wrapped cap and clamp it in your vise with the bearing shoulder down against the vise jaws for support. Line the cap center up with the drill and clamp the vise in place. Drill through the cap. If you do not have a lathe or drill press, do not try to drill the cap by hand. You will not be able to stay straight and centered, and the end result will be ugly. Lacking the lathe or drill press, buy a new cap with the sling swivel already installed. It didn't take a rocket scientist to figure out that a lot of shooters were not too keen on trying to drill their cap, and soon sling-installed caps became common. When I started gunsmithing, I did a brisk business drilling caps when installing sling swivels. By the time I left, a shotgun sling swivel installation involved drilling the stock and swapping the cap.

But not all shotguns have a magazine cap. Doubles do not have either a magazine or a cap. And you cannot install the sling swivel in the forearm. Most doubles have the forearm held on by spring tension, and the forearm keeps the barrels on. If you install a sling swivel in the forearm you risk pulling the forearm off the gun and dropping it muzzle first into the mud.

On side-by-side shotguns you drill and tap the bottom rib for a sling swivel stud. On over/unders, you use a barrel clamp.

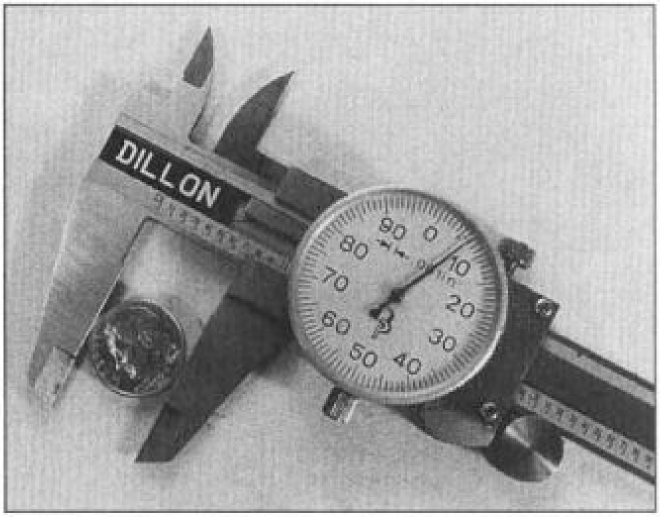
For the side-by-side, take the front base out of the package and measure the hole spacing. You will need a #43 drill and a 4–40 tap. Make sure your gun is unloaded and take the barrels off. Ahead of where your forearm ends, mark the hole spacing on the centerline of the bottom rib. Centerpunch the hole locations to keep the drill bit in place when it starts cutting. Put a strip of masking tape on either side of your barrels to protect them in the vise. Clamp the barrels into your drill press vise and chuck the drill bit in place. Drill the holes and tap them. Deburr the edges of the holes and tighten the sling swivel base into place.

On the over/under use your dial calipers to measure the diameter of the barrel. Measure the diameter of the lower barrel in front of the forearm. Uncle Mikes makes their barrel clamp sling swivel studs in several sizes. Select the size closest to but slightly larger than your barrel. The stud comes with two screws, the spacing screw and the locking screw. The spacing screw is also the pivot hole for the sling swivel. Screw the spacing screw into the stud extension, and place the two halves on the barrel by hand. Adjust the spacing screw until the two extensions of the stud are parallel. Install the locking screw and tighten the swivel stud in place.

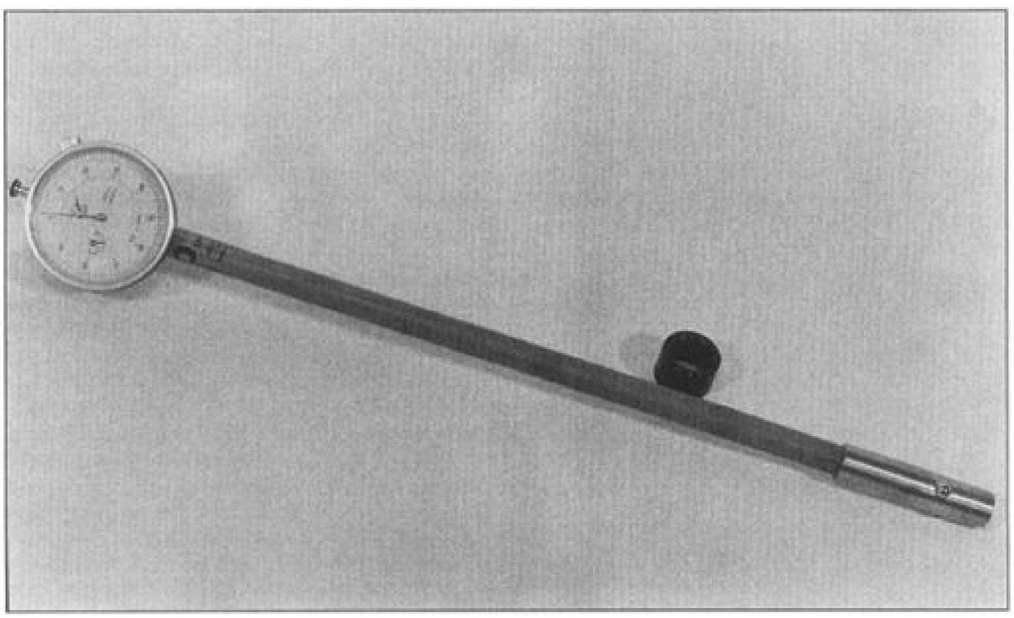
Chapter 6
Chokes

The simplest way to describe choke is that it is like the constriction you apply to the end of a garden hose with a nozzle. By adjusting the nozzle you change the spread of the water. As you decrease the room for the water, the stream becomes narrower and narrower. In both the hose and the shotgun barrel, if you tighten too much your water goes awry and the stream widens. Unlike the water from a hose, shotgun pellets do not gain velocity by being constricted. The increase in the water velocity is due to the increased pressure created by the constriction. Water is an incompressible medium, so the increase in pressure can only be relieved by higher velocity of flow. The shot in your shell is not compressed so much that any appreciable velocity increase can be measured.

What can be measured, and what matters to most shooters, is the change in pattern size as a result of this constriction. What can be measured and doesn't matter much is the inside diameter of the barrel at the muzzle. Some of you may have seen a shooter examining shotguns at a gun show, measuring the chokes with a dime. Many shotguns are rejected because the dime will pass into the choke. “A blown choke” is the diagnosis. The problem is two-fold; dimes aren't made that precisely, and neither are barrels. When I sat down to write this chapter. I happened to have five dimes in my pocket. They measure from just under .700″ to just over .705″. Not bad for coinage, but a pretty casual measuring tool. The nominal bore diameter of a 12-gauge shotgun is .729″. A choke would have to be .025″ less than the bore to stop a dime. So, by the old-timers dime method, every choke not a full choke is a “blown choke.” In fairness to any old-timers still out there, it seemed like the only choke made for decades was the full choke.



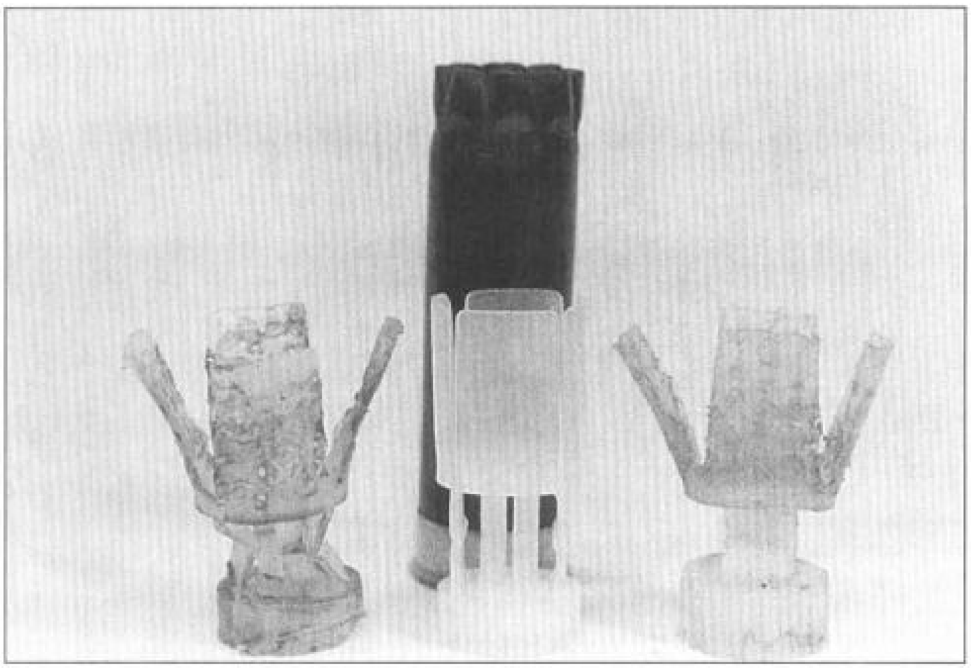
A dime is not a precision measuring instrument. This one measures .707 inches.



To properly measure a choke or bore, you need a deep-hole gauge.

Choke is not an absolute measure, but the difference between the bore diameter and the choke diameter. Two examples will illustrate the dilemma our old-timer faces. One shotgun is an Ithaca that happens to throw slugs into tight groups. A dime has no chance at passing into the muzzle, as it (and

the bore from forcing cone to muzzle) measures .703″. A tight choke? No, a minimum dimension bore with no choke at all. Anyone expecting tight patterns from this barrel because the muzzle stopped a dime would be disappointed. While it shoots slugs into tight groups, it delivers just what you would expect from a cylinder-choke barrel. The other barrel is on an old Remington Model 11. The muzzle (thus the choke) is so large you could throw a handful of dimes into it. The muzzle inside diameter is .725″. The bore is .739″, and the barrel delivers a uniform Improved Modified pattern. A dime won't tell you anything about either barrel.



A wad leads a hard life, but it protects both your bore and your pellets.

This is a Foster slug. It rides through your bore bare, and the ribs only keep it from putting too much stress on your choke. The wads fall away after everything leaves the muzzle.

A choke is only in the end of the barrel. I had repeated requests to cut long barrels back to “reduce the choke”, and found that quite a few shooters were under the impression that the taper of a choke extends the length of the barrel. It does not.

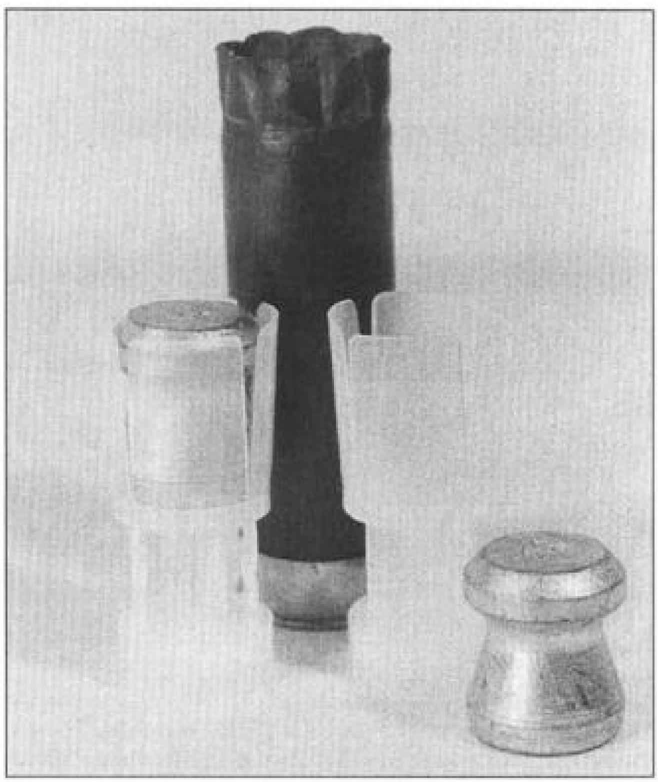
Choke is a variable thing, and performance can vary from one shotgun to another with the same marking, and can also vary for an individual barrel with different loads. Yes, you can alter the performance of your shotgun by feeding it different loads. In older shells the pellets on the outside of the payload look their trip down the bore pressed tightly against the steel of the barrel. At most they would have a paper wrapper to enclose the payload, a wrapper easily torn when the pellets moved. They would end their trip to the muzzle with flat spots. Once in the air, the flat spots caused the pellets to act like knuckleballs. The pellets with flat spots would wander out of the pattern. The one-piece plastic wad protects the pellets, reducing the number of flattened and wandering pellets, and thus tightening the pattern. Harder shot deforms less than softer shot and shot plated with hard material deforms even less. Plastic granulated buffering powder prevents even more

deformation. The lack of deformation reaches its peak with steel shot. The steel pellets are so hard they can score unprotected bores. (In an irony of full-circle travel, you can actually "blow" a choke with steel shot.)

The use of hard shot with a hard plating is seen in the loads used by live bird competitors and deadly serious trap shooters. By using hard, plated shot they reduce the number of deformed pellets to nearly none, and ensure that all the payload goes to fill the pattern.

One question that comes up often is "Can I shoot slugs through my choke?" The old answer was "Sure, but you may not be happy with the results." Older slugs and many made today are the "Foster" type. The slug is basically a lead shot glass turned upside down. The "rock in a sock" balance and aerodynamics keeps the slug going in a more or less straight line. The soft lead skirt would squeeze down to pass through the choke, assuming it was large enough to touch the bore walls to begin with. Some brands of slugs were made under-sized to easily fit through chokes. The soft lead of the slug sliding down the bore and crashing into the choke would soon leave sheets of lead on the bore and choke, degrading accuracy. But for occasional use, it was safe and moderately accurate. Things have changed. With the rise in shotgun-only deer hunting, and the development of the rifled shotgun barrel, the sabot slug has dominated the serious hunting segment of the market. Sabot is French for shoe (And the origin of the word sabotage. Early in the industrial revolution, workers would throw their wooden shoes into the machinery, bringing things to a halt.) and pronounced "Say-bow" or "Sah-bow." Instead of a lead cup, the sabot slug is a smaller-diameter cylinder that rides in a molded plastic sleeve. The sleeve (the actual sabot) is made in two or more pieces. The sabot-enclosed slug rides down the bore with the sabot filling the bore and gripping the rifling. Once clear of the muzzle the sabot parts fall away from the projectile.

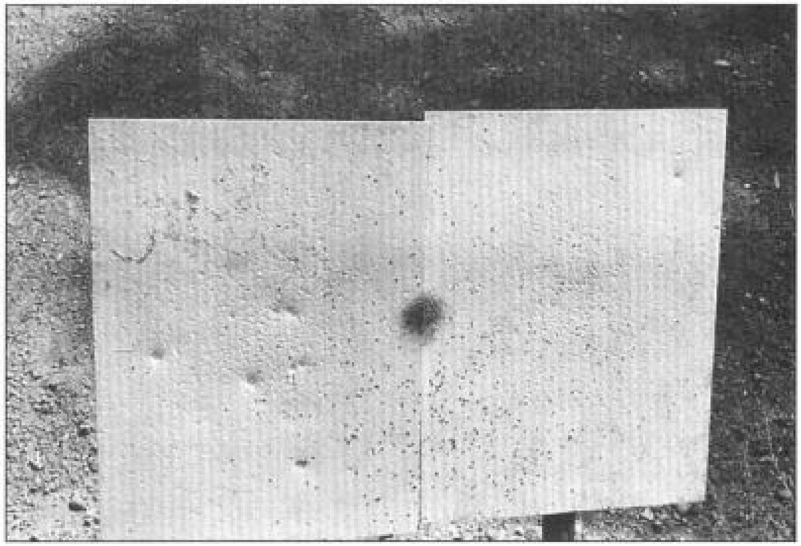
In a sabot slug, the two halves protect the slug from the bore, and spin the slug by grabbing the rifling.



The Lyman slug is one you can load for yourself. It fits into a regular wad, and loads like any other shotgun shell.

Without the sabot, this Remington Copper Solid would be too hard for the rifling. The petals of the Remington sabot fold out and release the slug once it leaves the muzzle.

The projectile can be made of a harder lead, for greater penetration. The Remington Copper Solid is made from (you guessed it) copper. The plastic of the sabot has to be hard and tough to grab the rifling. A sabot through a choke can be just as hard on the barrel as steel shot. You could damage your barrel after a few rounds of sabot slugs. Do not fire any sabot load through a fixed-choke barrel. The present sabot slug is designed for a rifled barrel. Early attempts were intended for smooth bores. Smith & Wesson offered a sabot slug that worked well by the standards of the day. (S&W once offered a line of handgun and shotgun ammunition. It was quite good but didn't last very long.) The sabot projectile is much longer than its diameter. Without the forward balance like the Foster slug, the sabot is prone to tipping. Without rifling, a sabot slug can be less accurate than the older style. With rifling, a sabot slug can be nearly as accurate as a rifle. To a greater degree than rifles, shotguns can be particular about what they shoot accurately. If you can stand the recoil, it is worth it to experiment with different slugs. In addition to the practice you get, you learn which slugs your barrel prefers.



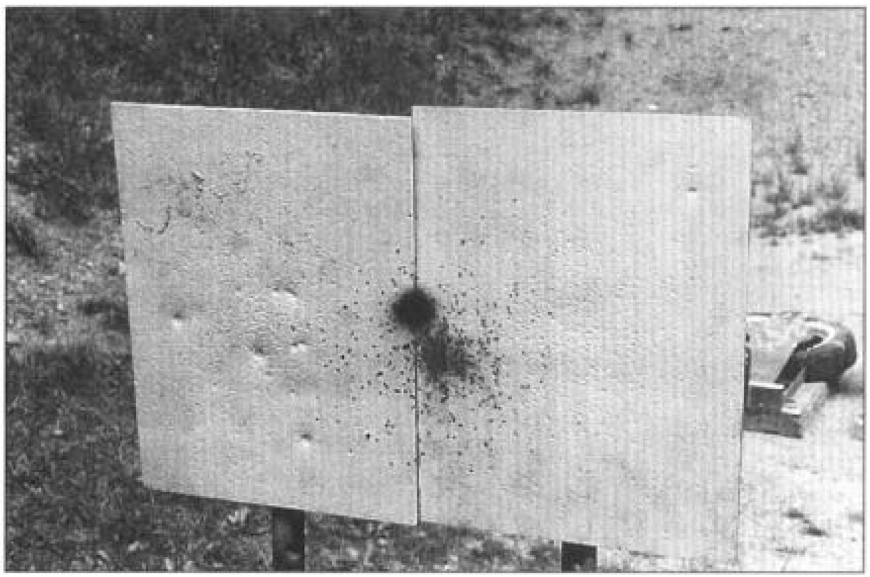
***These portable (barely) plates are a quick method of determining pattern-to-bead alignment, and pattern size. This gun patterns low for this shooter*.**

One Remington 870 barrel I have is marked “Modified,” and is a perfect example of a barrel that changes its performance depending on the ammo it gets. It must have been reamed on a day when the barrel guys were reaming bores with a worn, old reamer and chokes with a brand new one. It measures barely tighter than Skeet, and delivers Skeet performance with soft lead shot. Feed it high-antimony (harder) shot, and the pattern approaches Modified. In the interests of research, I fed it nickel-plated trap loads, and found the pattern delivered a nearly Improved Modified percentage. At the risk of damaging the barrel I tried three rounds of steel BB's. (The barrel is an old, non-ribbed barrel with a fixed choke that pre-dates steel shot. I don't want to damage it by using too much steel, but I had to know.) It delivered 69%, 70% and 73% patterns. This goes to show that the same shells that are so devastating on ducks in your hunting buddies' shotguns may not do nearly as well in yours. Performance of ammunition in other shotguns will not tell you what your shotgun will do.

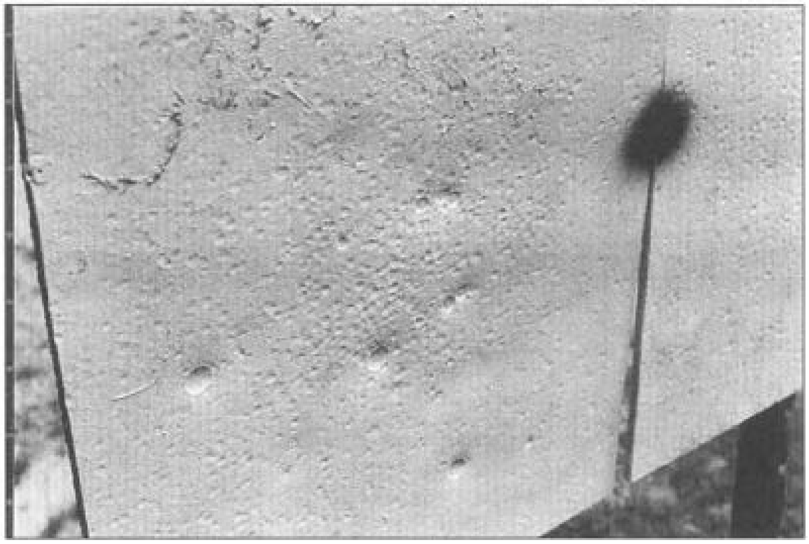
But shooting on a pattern board will. In the old days, (and even today for serious shotgun gunsmiths) the pattern “boards” used by serious researchers were heavy gauge sheet metal stands or plates. The plate would be coated with paint or whitewash. Each shotgun pattern would be gauged and analyzed, then the test panel would be re-painted and fired again. One term for a shotgun whose pattern has been tested, regulated and adjusted is

“plated.” It was fired against the steel pattern plate, and found acceptable. I don't know of many sheet metal panels that would stand up to a load of steel BBs for use on ducks or geese. If you are serious about patterning loads, it is far easier to build a wooden frame and attach paper sheets to it. Butcher paper is white but only comes in rolls 36 inches wide. Craft wrapping paper from a wholesaler or printing supply store comes as wide as 48 inches, and can be special-ordered as wide as 60 inches.

***A full choke at 25 yards, and a good bead/pattern alignment*.**

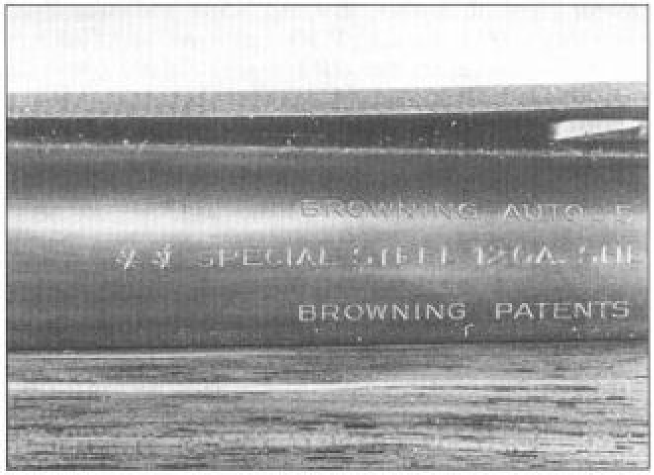


Testing is simple, if arduous, work. Find a location on your gun club or property where you can stand your fixture up 30 or 40 yards from a shooting bench. Use a wide felt-tip marker, or a hole cut through a piece of cardboard and some spray paint, and make a solid 5-inch circle. An aside here: The traditional measure of choke does not take into account the location of the pattern in relation to the aiming point. That is, choke researchers fire the round, then draw the circle centered on the pattern. However, a perfectly-formed pattern 3 feet from where you are aiming is not very useful for hunting or competition, and will have to be corrected. You might as well find out right away if you will have to shift the center of the pattern. Give yourself an aiming point.



Keep your pattern plates away from handgun shooters, and shotgun slugs. This plate has collected hits from three 12-gauge slugs and six .44 Magnum rounds.

This sheet is 3 feet wide, and available from a paper wholesaler. It is just what you need to pattern your gun.



Chokes are marked with words or with codes. This Browning (as they all do) uses stars. Two stars means Modified.

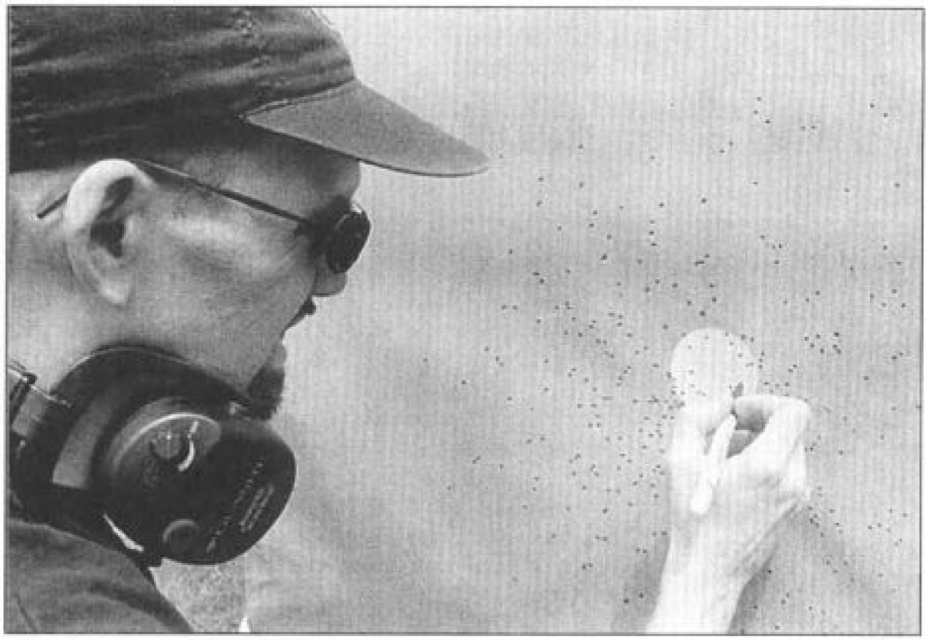
The traditional pattern test is the percentage of pellets inside a 30-inch circle at 40 yards. The traditional choke designations and their percentages are:

Full	65 to 75%
Improved Modified	55 to 65%
Modified	45 to 55%
Cylinder	35 to 45%
Cylinder (or Skeet 1)	25 to 35%

The traditional distance is 40 yards, but you are not required to use 40 as the “correct” distance. If you shoot skeet you may want to measure your pattern at 30 yards, a distance closer to where you break the birds. Many practical shotgun competitors find a steel plate 25 yards distant is the farthest they engage, so they pattern their shotguns at 20 yards. A duck or goose hunter who has to deal with high and fast-flying birds may want to test his gun and loads at 50 or 60 yards. And the turkey hunter is not interested in how a load performs at a single distance, but rather how far he can go and keep a tight enough pattern.

Once the game of skeet had been developed, Cylinder was found to be too open, and Improved Cylinder was too much. Skeet 2 was developed to deliver performance in between. After 75 years of development, all the percentages and the choke constrictions went out the window when plastic

one-piece wads became common. The one-piece plastic wad protects the pellets, reducing the number of flattened and wandering pellets, and tightening the pattern. And, like I said before, harder shot deforms less than softer shot… etc.

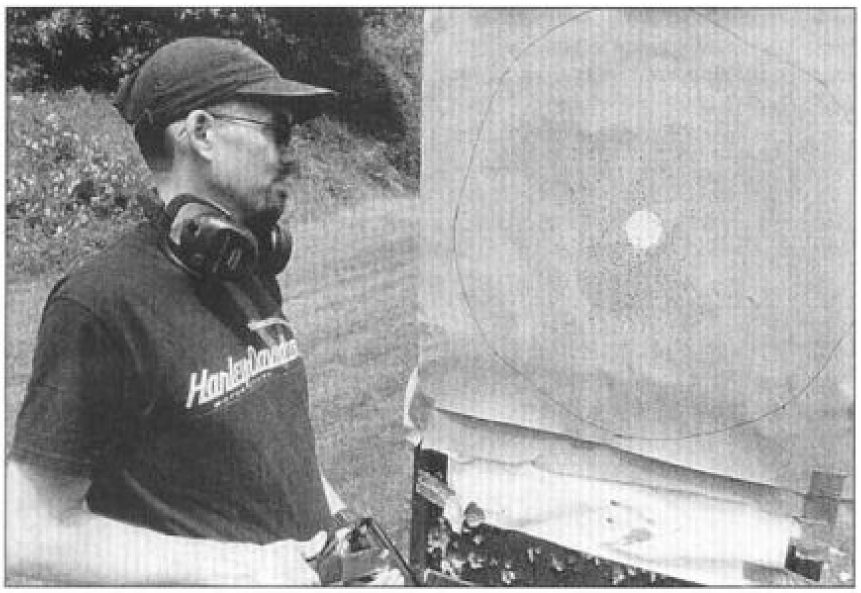


Once you've shot the pattern paper, then its time to mark the hits.

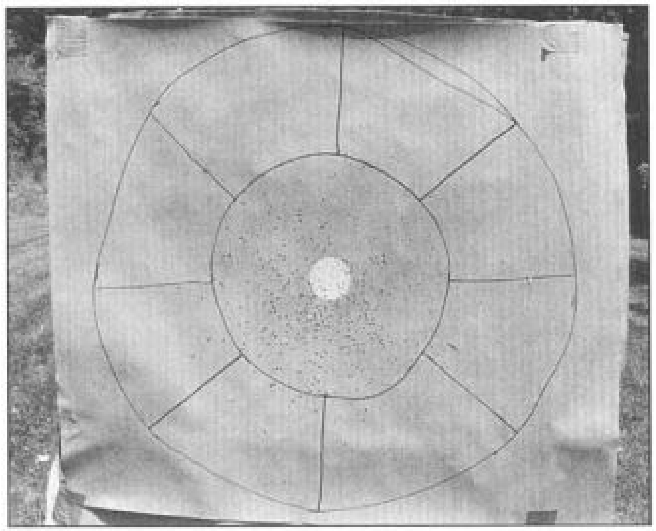
Large-diameter steel shot reacts to choking more efficiently to such a degree that you should use a degree of choke less than you would with lead shot to get the same performance. But enough theory, how do you measure your choke? Set your stand up at 30 or 40 yards. Take your paper and mark the aiming point. With a compass or a string and pen, draw a 30-inch circle around the aiming point. Staple or tape the paper onto your frame and sit down at the shooting bench. Resting the shotgun over sandbags, carefully fire one round on the paper. Now the drudgery begins. Take a felt-tip pen and mark each pellet strike. Count them as you mark them. Once you have counted all those in the ring, count those outside the ring. Total the two counts and calculate your percentages. Even with a 48-inch-wide piece of paper, with an open choke you'll have pellets off the paper. If your percentage seems suspiciously high, try again at a closer range.

Serious researchers turn a simple task into drudgery of a nearly government-mandated level. With all the reloading equipment at the range, they will count the pellets before loading them (I'm not kidding) and then count the holes in the pattern.

You can learn a lot about a pattern just by looking at it.



Reading patterns can be as simple or complex as you want it to be. The simplest method of pattern performance I have ever seen was with a unit of Marines being checked out on their issue 870 shotguns. The shooting was “pass-fail” and the targets were sections of the packing crates the ammo came in. Each piece of packing crate was thrown onto the bare dirt hillside being used as a backstop. To “pass” each Marine had to make his piece of packing crate jump with each shot. The patterns were assumed to be the same for each shotgun, and pattern performance was deemed sufficient if dirt splashed when the shotgun went off. Whew. Too simple for me, but they seemed happy. Their performance was more comforting than that of a large metropolitan police department, where I saw officers “qualifying” on their monthly shotgun review. The review consisted of firing five shots downrange under the watchful eye of the Range Officer. If they hit the backstop five times, and didn't hurt themselves or the Range Officer, they were deemed to have “Passed” in the “Qualification.” I do not stay long in that city if I can avoid it.



The Berlin-Wannsee grid, without its center cross. The results are from a .410 load at 20 yards, and a full choke pattern.

The basic method of pattern reading is the “eyeball” method. Shoot a couple of test patterns on your pattern sheets at several likely distances for your hunting or target shooting. Is the pattern centered on the aiming point? Is the pattern uniform enough that your target would be struck by several pellets if it was in the 30-inch circle? If the answers are yes, then you should get out and practice, and then go hunting.

If you want more information, you'll have to do more work. The rigorous method of measuring pattern performance is the Berlin-Wannsee method. In addition to the 30-inch circle, you'll have to draw a 15-inch circle. Divide the donut of the outer circle into 12 segments, with lines at the hour markers. Divide the center circle into quarters. You will have a segmented target with each section roughly 44 square inches. Fire your shell onto this pattern. Count the pellets in each section, and outside the circle. The percentage of hits inside the pattern tells you the choke your gun and load are performing at. The count in each box or segment gives you a gauge of the uniformity of your choke at that distance and with that load. To see if your pattern is uniform enough, take the outline of your target and slide it over the marked-up pattern. Is there any place in the circle your outline can rest and not touch a pellet hole? The gaps in your pattern might let a game bird or clay pigeon escape even when you are aiming correctly. If your patterns are patchy, either your gun doesn't like that load, or you are too far away. In fact, when

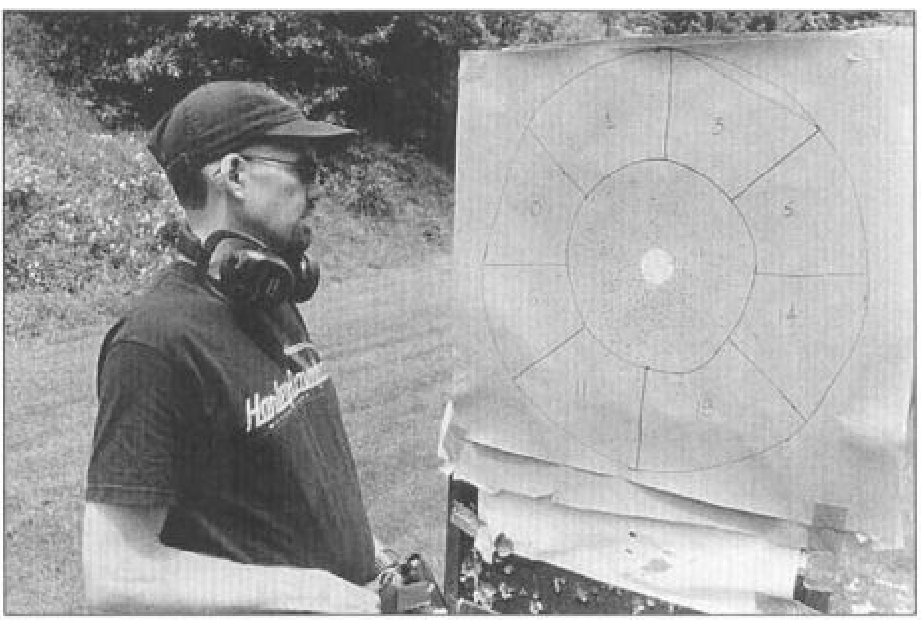
your pattern gets to the distance where your segments in the ring and the segments in the center have equal numbers of pellets, you have stretched 5 or 10 yards past the effective range. Even after counting and comparing, you will have to slide your cutout over the paper to make sure there aren't any patches in the pattern.

Is all this a lot of work? Yes. But the information gained not only improves your performance at the range or in the fields, it increases your confidence.

Types of Chokes

The simplest method for a factory to form a choke in a barrel is to wring the end of the tube lighter. While common in inexpensive shotguns in the lead-shot era, you would be hard-pressed to find a shotgun choked in this manner today. Steel soft enough to be swaged into a choke is too soft to stay in place under the hammering of steel shot.

With the gird drawn and the holes counted, you can tell if your pattern is consistent. This one is not, but the average of it and the next four might tell us more.



Fixed chokes are formed by leaving the muzzle end of the bore a slightly smaller diameter when the final reaming is done. The choke can come in one of several shapes. The cone choke is just that, a cone at the muzzle. The taper constriction of the choke continues until it runs out of barrel. The bored

choke is a cone tapering down to the choke diameter followed by a tubular section of the same diameter. The mysterious choke is the jug choke. The jug choke is a recessed open section followed by a bore-diameter section. The payload begins to expand into the jug, and then is constricted by the next parallel section. Jug chokes came about as a means of getting some amount of choke back into a barrel that had to be shortened. Cutting off a barrel that had the muzzle split from being fired with an obstruction meant losing the choke. The big advantage the jug choke has is that it offers a moderate amount of choke to a payload of shot, while not causing a problem with slugs.

		Amount of Constriction					
Gauge	Bore Dia.	Full	Imp. Mod.	Mod.	Skt-2	Imp. Cyl.	Skt-1
10	0.775	0.036	0.027	0.018		0.009	
12	0.729	0.035	0.025	0.019	0.012	0.009	0.005
16	0.0667	0.028	0.020	0.015	0.010	0.007	0.004
20	0.617	0.025	0.019	0.014	0.009	0.006	0.004
28	0.550	0.022	0.016	0.012	0.007	0.005	0.003

In the old days before interchangeable chokes, every shotgun barrel left the factory with some kind of choke. Judging from the numbers I have seen, the first half of the 20th century was the time of the Full choke. In the latter half, Modified became more popular. For many applications, they are both too tight. To open up a choke you'll need an adjustable reamer, a wrench for the adjustable reamer, a handle, dial calipers and a barrel caliper or a bore gauge, some cutting oil such as Do-Drill and a cleaning rod. You should also have some means of marking the barrel to indicate its new choke. The customary method is with a metal stamp to re-stamp the markings. The last part of a choke reaming job requires a barrel hone.

The choke reamers come in four sizes. The original adjustable reamers may not have originated with shotguns. I have seen a full set of adjustable reamers that was composed of more than a dozen reamers, of overlapping reaming sizes. I suspect the need for such a reamer was conceived of so early in the industrial age that the reason for which it was built has been lost to the ages.

The four sizes we are concerned with are the sizes available from Brownells, B, C, D, E. The B is the 28-gauge reamer, and the E is the 10- and 12-gauge reamer. To work on .410 shotguns, you will need either a #108

or #109 reamer. The reamers can cover only a certain range of diameters, but you don't need much for choke reaming.

Reamer	Gauge	Smallest Diameter	Largest
#108	.410	.375"	.406"
#109	.410	.406"	.437"
B	28	.531"	.593"
C	20	.593"	.656"
D	16	.656"	.718"
E	10/12	.718"	.781"

The choke reamers are precision cutting tools, and should be treated gently. Store them oiled and in their own containers. Before you put them away, loosen one of the nuts to relieve the tension on the assembly. When you first pull one out of its box, turn the loose nut finger-tight to make sure the blades can't work loose, then proceed with the reaming job.

Remove the barrel from the receiver and place it on your bench. Scrub the bore squeaky clean. If you have a shotgun made in the US, you probably don't have to worry about chrome-lined bores. Many Italian shotguns have their bores lined with chrome, and some Spanish shotguns are plated inside. To check for chrome plating, first look at the barrel near the choke markings. In many cases the manufacturer is proud of their extra efforts, and mark the barrel. If you still aren't sure, scrub the choke area with some 0000 steel wool. Degrease the area and dab a little cold bluing solution on with a cotton-tipped applicator. Bare steel will react to the cold blue, while chrome plating will shrug it off. If you find your bore is chrome plated, you cannot ream your choke out with regular reamers. You must have carbide-tipped reamers. A carbide reamer costs at least three times as much as a regular reamer, and if you buy the reamer for one job you will end up spending more money than having someone who already has the reamer do the job. It may just be more cost-effective to have someone else do the work on chrome-lined bores. I have talked to other gunsmiths who have resorted to grinding the chrome out with a barrel hone, buckets of lubricant and a days work. I have not done it and cannot recommend it. If you attempt this method and overlook one patch of chrome, your reamer will be ruined. If you have chrome-lined bores, send it out and have a pro do it.

Assuming you have a steel bore that is not chrome-plated, and with your bore clean (You don't want powder or plastic fouling to interfere with your

measurements. You also don't want them in the choke, getting in the way of the reamer and possibly dulling it.) you're ready to proceed. With the bore gauge or dial calipers and barrel calipers, measure the diameter of the bore and the diameter of the choke. One advantage of the bore gauge is that you can easily determine if your choke is a cone shape or has parallel sides. Compare the bore diameter to choke diameter constriction to the choke chart. If the barrel is Full choked, and you want to open it to Modified, look at the amount of constriction on the chart.

Once you have determined the diameter you want your choke to be, you will ream it until it is still a couple of thousandths smaller. You can always ream more, but you can't put steel back. With the choke slightly under your goal, take it to the range and pattern-test it. If it is more open than before, but still too tight, you can ream it some more. The ideal situation would be to take your tools to the range and ream the choke there. You could pattern test the barrel and even shoot some clay pigeons until the choke is perfect. Alas, not all of us can work at the range, and so the two-step choke reaming process is a compromise.

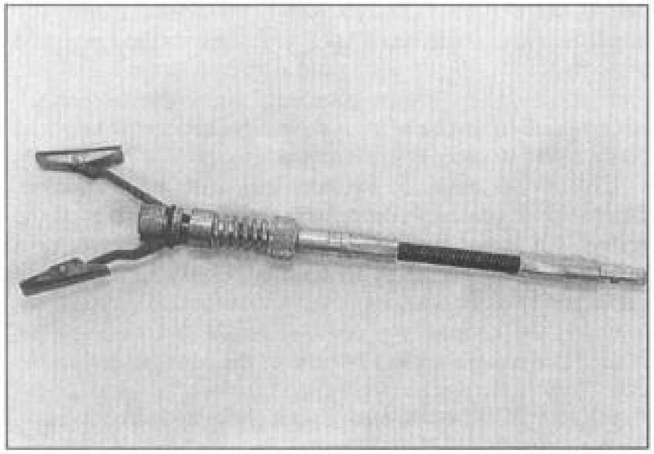
Clamp your barrel in a padded vise with the muzzle up. Clamp it so you can comfortably work the handle of the reamer, but do not clamp it in the choke area itself or the area right behind the choke. A shotgun barrel has relatively thin walls, and you can clamp it slightly out of round. If you ream it while it is clamped, you could end up with an oval choke. Place a can under the chamber end of the barrel to collect the cutting oil and chips created by the reaming.

Measure the exit diameter of your choke and write it down. On our demo barrel we will be taking a Full choke 12-gauge barrel down to Modified. The bore diameter on this barrel measures .735″, not unusual. The bore diameters of shotguns have been all over the place in the 20th century. The Full choke on this barrel has an exit diameter of .705″ And has only .030″ of constriction. A Full should be .036″ constriction, but as with cars, mileage varies. We want to bring the constriction down to .020″, a little tighter than the chart-indicated Modified. With it initially reamed, we'll test and adjust.

The adjustable reamer has six or eight blades that cut the steel of the barrel. Each blade rests in its slot cut in the threaded shaft of the reamer body. The slots are cut at an angle to the centerline of the body. The blades are held in the slots by nuts at the top and bottom. By adjusting the nuts you slide the blades up or down the shaft. As they move up, the slots become

shallower, and the cutting diameter of the blades increases. You can measure the blades to adjust them to the initial setting, but it is faster and easier to simply turn the nuts until the blades enter the choke. Set the blades so the reamer just enters the choke without cutting. Turn the upper locking nut half a turn up the shaft and then tighten the lower one firmly. Brush cutting oil on the blades and lower the reamer into the choke. Keep the reamer vertical as you turn it and press down. Cut until the reamer has passed through the choke. Lift the reamer out and brush the chips off. Turn the upper nut half a turn up the shaft again, and tighten the lower nut firmly. Each half-turn of the locking nuts up the shaft increases the cutting diameter by half a thousandth of an inch. If you try to cut more than that on each pass you might get into trouble. You could wedge the reamer in the choke. You could create chatter marks from having to use so much force. You could turn the barrel in the vise, bringing the rib against the padding and marring it. Rather than try to hurry things up by cutting too much, remove small amounts on each pass through the choke. Once you have reamed the choke five or six times by this method, set the reamer aside and measure the choke. Wipe the choke clean with a cleaning rod and patch. Measure the choke. Look inside the barrel. You should be able to see the freshly-reamed surface of the choke area. Calculate the amount you have removed. Compare that to how much you want to take off, and resign yourself to repeating the process a dozen or 20 times.

Once the choke is reamed to your first test diameter, (in this case the barrel was opened up to .715″, our first test for Modified) clean the bore and take it to the range with your test ammo and pattern frame. Check the pattern. If it delivers the pattern you want, there is no need to ream any more. If it is stilt a bit tight, then scrub the bore and repeat the reaming process until you reach your desired diameter. Pattern performance varies from load to load. You must test the barrel, before and after reaming, with the exact load you will be using in competition or hunting. You can't depend on another load being “good enough” or “pretty much the same” when checking chokes and patterns. Use the real thing. In the case of the test barrel, it was patterning a little tighter than the Modified desired, so it went back to the bench. When you go back after test-firing to ream again, scrub the bore clean. The powder and plastic residue can dull your cutters, making the job more difficult in the future. The second reaming brought the constriction down to .017″, and pattern testing determined it to be perfect for Modified.

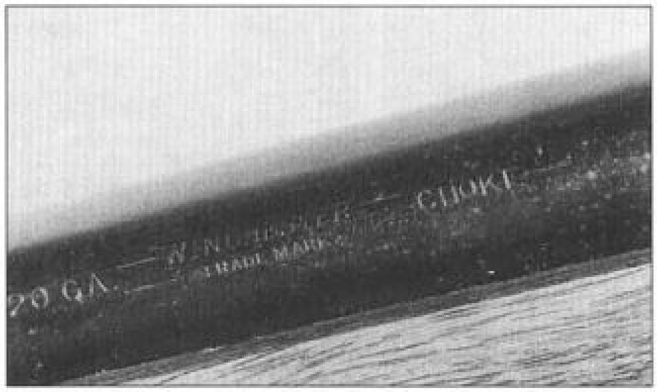


Use a barrel hone to polish a choke after it has been reamed.

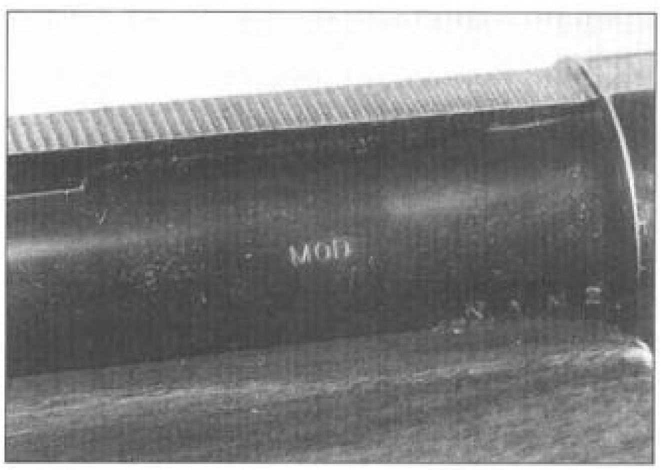
Once reamed, you have to polish the choke. In the days before one-piece plastic wads, serious shooters would insist on having the parallel “pipe” of their choke roughed up. By using a coarse hone, the surface of the choke would be scored but not reamed larger. The prevailing theory was in reaction to the nature of shot shells at the time. Instead of a one-piece wad, the shot was powered forward over a stack of fiber or felt wads. The wads took up the excess space and provided a cushion for the shot. When the wads followed the shot out of the muzzle, the lighter wads would get a boost from the muzzle gases and strike the back of the shot column, disrupting it and causing patchy patterns. (Or so the theory went.) By roughing the choke surface, the wads could be slowed down in their passage through the choke, and not disrupt the pattern. One-piece wads are not separate from the shot, but wrapped around it. All a rough-surfaced choke will do with today's shells is collect plastic fouling faster. Use the bore hone to polish the choke surface.

Re-mark your choke designation. If the choke is indicated by a series of stars or asterisks, the “I” or single blade marker works fine. Use it to add stars or asterisks until your markings show the level of performance your barrel delivers. If the barrel is marked with a word or contraction, use a small punch to obliterate the word and create a panel. On the panel stamp the new designation. It may seem like a fussy thing, marking your barrel. If you only have one barrel for one shotgun you can keep track. One advantage of the removable barrel system is that you can easily switch barrels. So, you pick up a used barrel at the gun show and ream the choke for perfect

performance at the gun club. You do not want to get your Skeet-choked barrel and your Full-choked barrels mixed up. Your scores or your day of hunting would suffer.



The Full choke was so common in the first half of the 20th century, all the makers had to do was mark "choke."

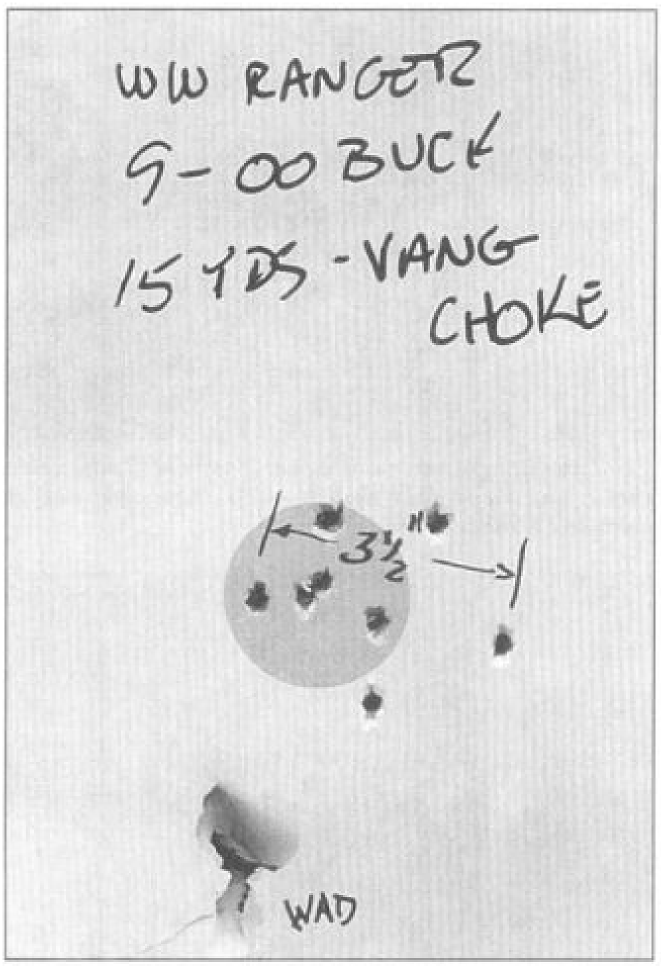


This Remington is marked "mod" for Modified. If you ream the choke out larger, be sure to re-mark the barrel.

Choke

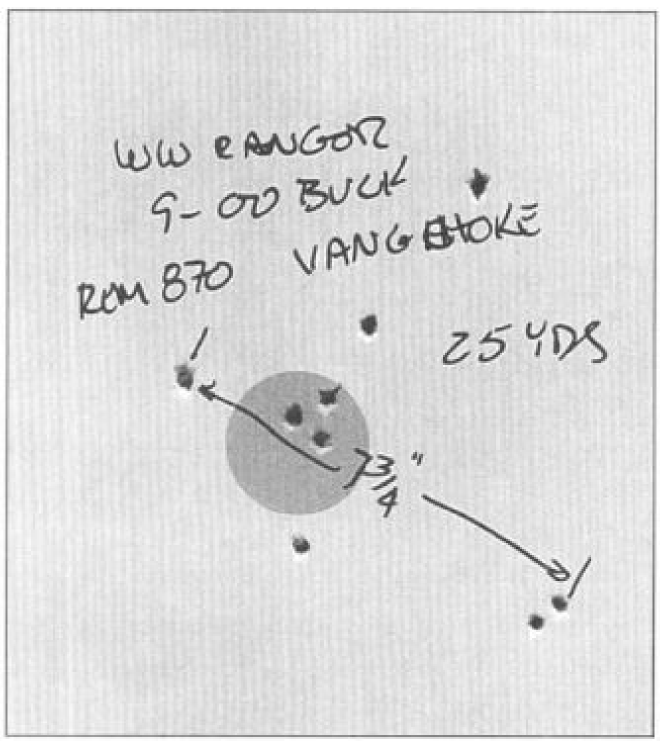
The Vang is intended for use in defensive shotguns or practical competition shotguns. Hans Vang creates the choke by first measuring the

inside diameter of your barrel. He then reams the forcing cone longer, and back-bores the barrel. He leaves an extra-long section of bore diameter alone at the muzzle, to create the choke. I am not being deliberately vague about the method and dimensions, Hans keeps the details to himself. The Vang offers several advantages. The choking does not seem to differ as greatly in performance from shot size to shot size. With a regular choke, you can have a barrel that delivers Full choke patterns with large shot like #4 buckshot, but less than modified with fine #7 shot. If you lighten a regular choke to deliver Full with the #7 shot, the buckshot pattern can go all to hell. The overly constricted buckshot can be deformed by the too-tight choke and the resultant fliers knuckleball out of the pattern. The Vang delivers much the same pattern regardless of the shot size. The big advantage of the Vang is with slugs. The choke does not deform slugs, and delivers good accuracy without losing the choke performance.



The Vang choke produces results like this. Yes, 3.5 inches at 15 yards!

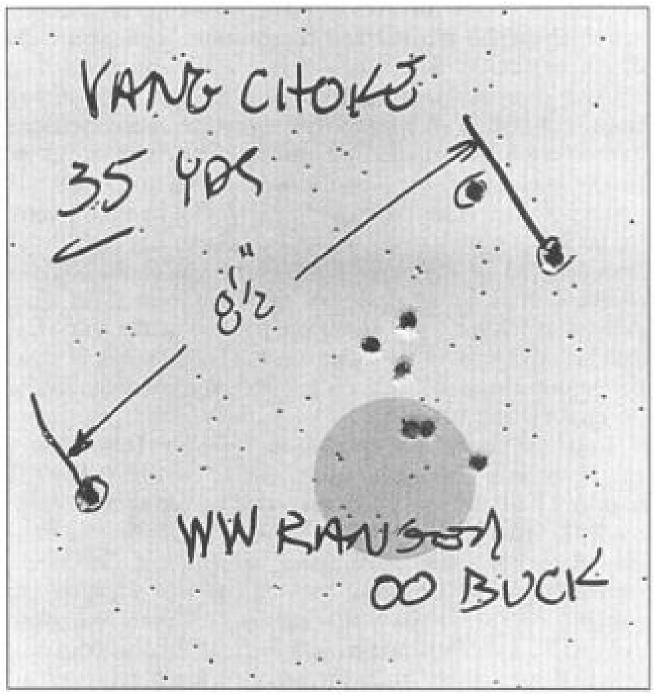
I sent the barrel from my Gunsite 870 off to Hans Vang. I call it that even though it hasn't been to Gunsite (I have, it hasn't). I built it to go there, but ended up taking a Remington 1100 instead. I can't remember why. The barrel is a standard late-production Remington smooth-bore barrel 21 inches long with rifle sights. Lacking choke of any kind, the patterns were what you would expect of a cylinder-choked gun. At 7 yards, it would pattern Federal Tactical buckshot into an 8-inch circle. At 20 yards I could just barely keep all of the nine pellets on a silhouette target. The open patterns were offset by its good slug accuracy. Except when using my Secret Sabot Slug load, this barrel would deliver a five-shot group of around 5 or 6 inches at 50 yards. For a random off-the-shelf smooth-bore slug barrel, that is pretty good.



***… at 25 yards, the pattern is the spread of a large hand*.**

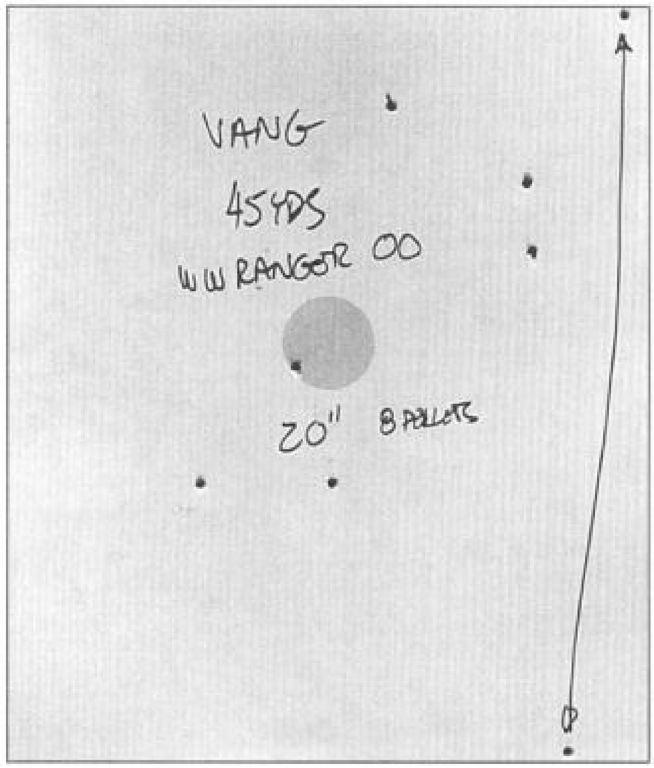
Once it came back. I could easily see the back-boring that had been done. The forcing cone had been extended on an angle that would make it 2-½ inches long had it not been back-bored. The choke is a long cylindrical

section that extends the last 1-½ inches. Hans tells the that he has seen as much as a 3 or 4 percent increase in velocity because of the back-boring. My atmospheric conditions vary too much from one range session to the next to measure that small of an amount. I guess Vang's location in the high desert and the uniform conditions there makes such measurements easier.



These are the results at 35 yards.

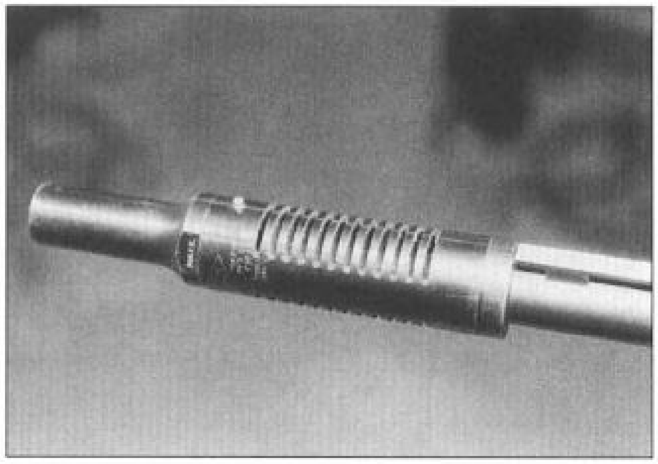
The performance was markedly improved. Federal Tactical buckshot now patterns much more tightly. At 7 yards, the pattern is around 4 inches across, and I can keep all the pellets on a silhouette out to 40 yards. Except for my loaded SSS, it shoots slugs better too. It puts Remington Slugger Foster slugs into 4 inches at 50 yards. Like many other shotguns, it shoots Brenneke slugs even better. If I do my part, it will put five Brenneke slugs into 3 inches at 50 yards. This 870 is not the only shotgun to favor Brenneke slug. It almost seems like a rule of nature that your gun will perform the best with the most expensive and hardest-kicking ammo available.



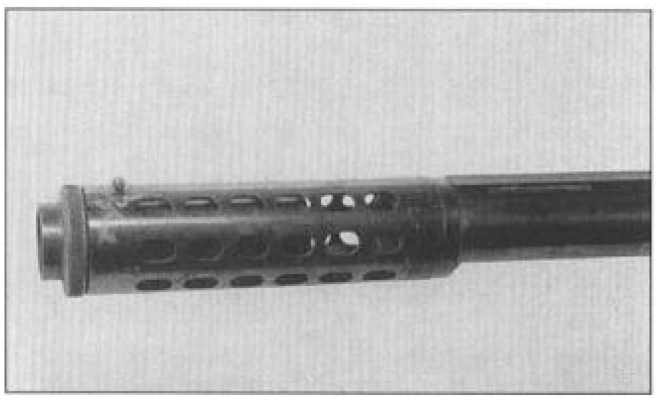
***Past 40 yards the group starts to become unusable*.**

Adjustable Chokes

Even when shotguns with easily-changed barrels were available, not everyone went for them. The cost of changing chokes was the cost of a new barrel. As ever, shooters searched for more. Two early approaches to variable chokes were the Cutts Compensator and the Marbles adjustable choke. The Cutts looks like a pickle on your barrel. The expansion chamber has slots cut on the top and bottom to reduce felt recoil. At the front of the expansion chamber you can thread in different choke tubes. Once installed, changing chokes was a matter of unscrewing the old front tube and replacing it with another.



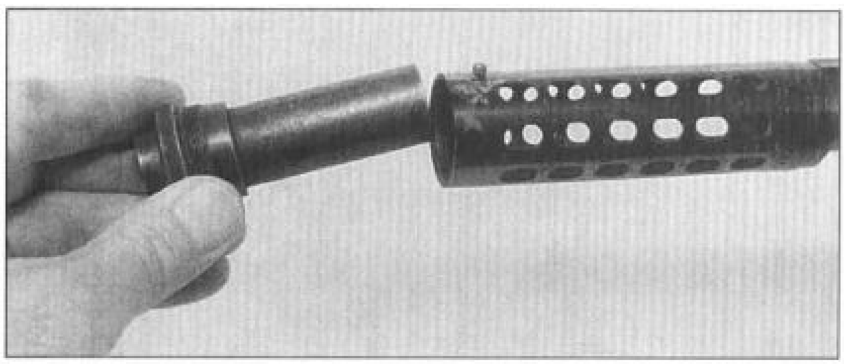
The Cutts Compensator was an early attempt at adjustable chokes and recoil reduction. It works reasonably well at both, and is still available.



This "Power Choke" is a Cutts copycat, with the choke tube inside the cage instead of outside.

The Cutts is not very elegant, and having a pocket full of choke tubes did not appeal to every shooter. The Marbles choke takes a different approach. The choke constriction is created by spring steel "fingers" attached to the muzzle. A tapered cap threads over the fingers, and as you turn the cap down, it tightens the fingers. For many years Mossberg offered the same choke system as their "C-Lect Choke." Both the Mossberg and Marbles chokes were quite popular before the newest generation of threaded choke tubes became popular, and if you go to a gun show you are likely to see many barrels with them installed. To set the choke for any level of

performance is a simple matter, and range-testing to get the perfect size pattern is a piece of cake. To use the marbles with slugs, open the setting to “zero” or “slug” and try it. I have found that using one or two clicks tighter than the slug setting can often improve accuracy quite a bit. Don't tighten more than two clicks, as you are simply creating a smaller hole for the slug to squirm through. The only drawback is that you can't install it yourself. But the cost is reasonable, and Marbles even offers a model that has a recoil-reducing cage on front, similar to, but smaller than, the Cutts expansion chamber. The choke works very well, and if you are offered a barrel that has one, do not even think of cutting it off to have the barrel threaded for screw-in choke tubes. You will be spending money needlessly.

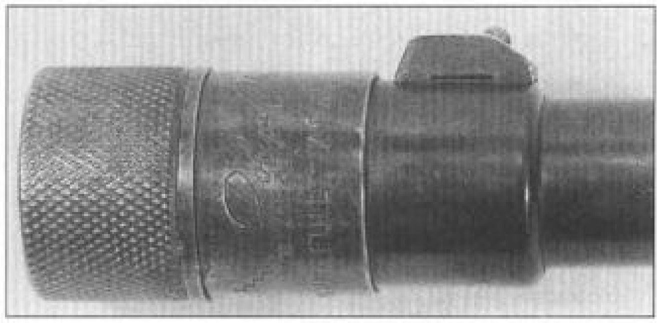


If you unscrew the choke and replace it with a different one, you can adjust pattern size to meet your needs.

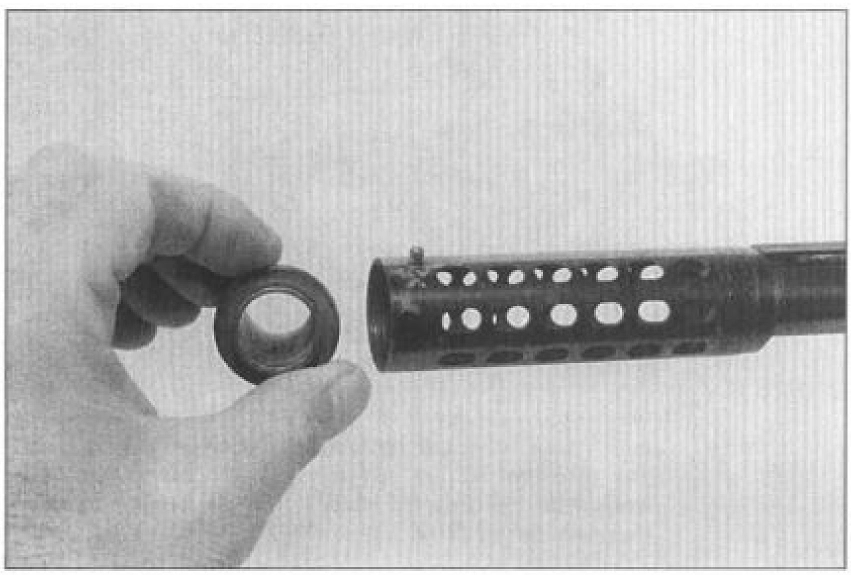
Interchangeable Choke tubes

The idea of interchangeable choke tubes is not a new one. Even the idea of hiding the tubes inside the barrel is not new. The obstacle to interchangeable choke tubes was as it is with so many things, cost. The cost of creating the reamers and taps. The cost of machining tubes and threading them. The cost of special alloys for both barrel and tube. The barrel alloy was not a problem. The alloy for the choke tubes required more work. The tube is very thin, and must be hard enough to hold threads that will take the load. It must also be hard enough to take the impact of the payload, round after thousands of rounds. If the alloy is too hard, the tube will crack or break. If too soft, it will expand after a number of rounds, and be immovably wedged in the barrel. For a while it looked like screw-in choke tubes might be a passing

fad. Tubes split, or bulged, and in either case couldn't be removed from the barrel. Tubes also flew out of the end of the barrel they were in. And who wants to walk around hunting with a pocket full of choke tubes?



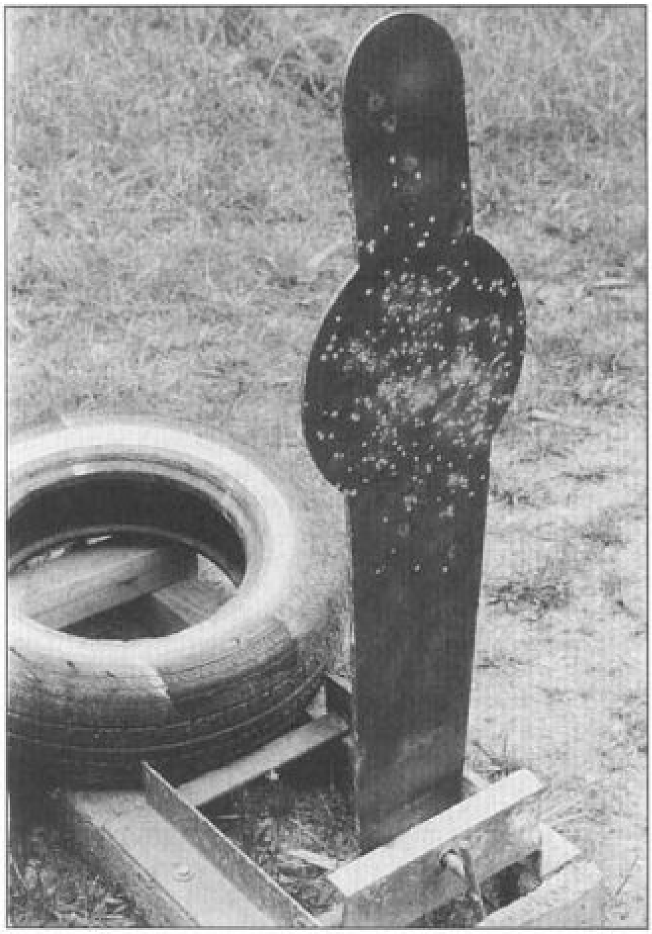
The Poly-choke from Marble Arms does not require extra tubes. The outside ring compresses spring steel fingers inside, constricting the shot.



The inner diameter determines the choke.

The problem has been solved, and screw-in chokes are here to stay. The convenience of having whichever choke you want right away kept shooters trying, and manufacturers improving, choke tubes. The only problem in the early days, was which one? It seemed that every new make of shotgun that

came out with choke tubes used a different thread pattern. The debate raged. Would the manufacturers see common ground and settle on one or two? Or would they continue to offer essentially incompatible choke lubes? The pessimists won. If the number of choke tube patterns have not reached dizzying levels, they certainly are confusing. The following list should be of some help.



Yes, you need choke when shooting at falling steel. Without enough pellets on it, this plate won't fall.

Gauge choke tube thread sizes

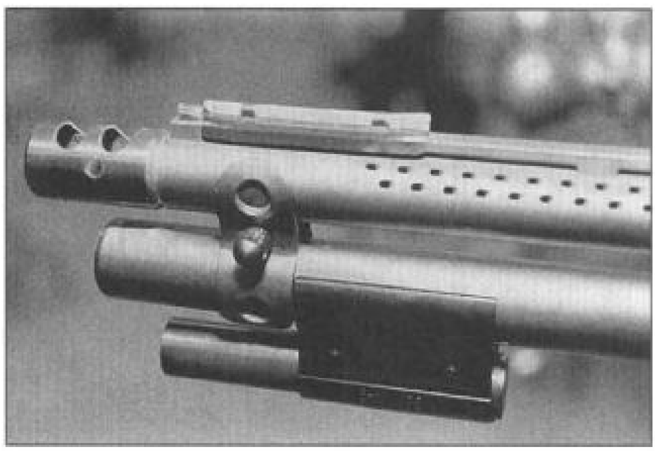
.812″-32 tpi	Win choke
	Rem choke*
	Mossberg Accu Choke
	Weatherby IMC
	Savage
.794″-44 tpi	Tru choke
.774″-44 tpi	Tru choke Thinwall
.820″-32tpi	Browning Invector
.874″-32 tpi	Mossberg Ulti-Mag
.817″-1 mm	Hastings choke tube II
.810″-1 mm	Beretta & Benelli

20 Gauge choke tube sizes

.687″-32 tpi	Win choke
.697″-32 tpi	Rem choke
.674″-44 tpi	Tru choke
.687″-32 tpi	Browning Invector

Choke tubes come in different threads, lengths and ported and non-ported. They also come made for lead, steel shot or both.

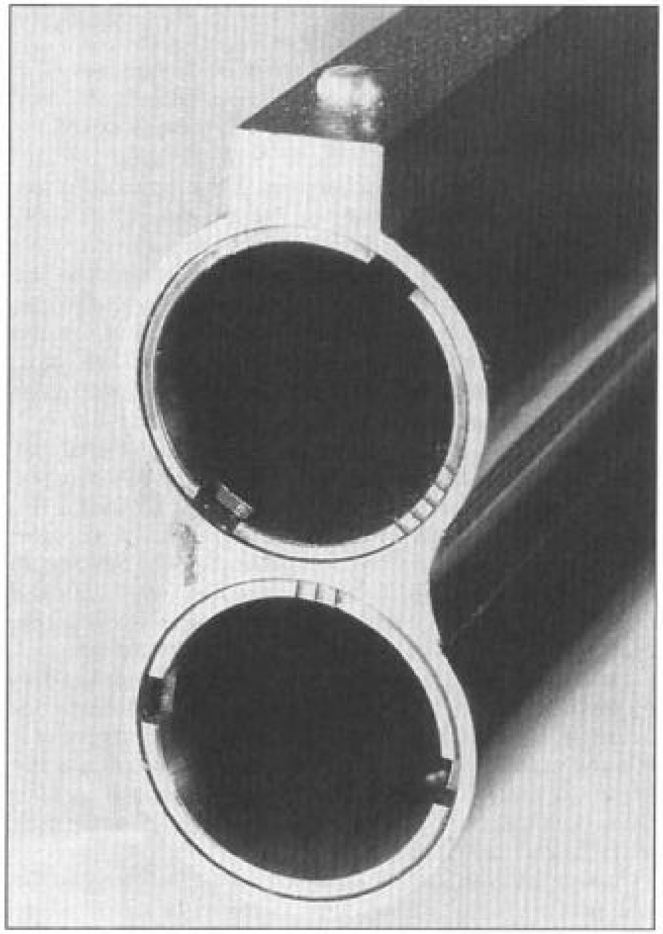
Instead of settling on a common size, each manufacturer figured it out for themselves and made their own tubes. In the early days, shooters would come into the shop asking for any tube that would fit. Even when the thread gauge and dial calipers said the tube should fit, a measured tube did not always go into a different barrel. We gave up swapping. Even where the thread size is the same, as with the Win choke and Rem choke, the length of the tubes are different. A Rem choke will stick out of a Win choke threaded barrel. You should use the choke tubes your barrel is made for, and not try to be cheap and use whatever comes by.



Screw-in chokes can also reduce recoil. This Briley choke is both choke tube and recoil-reducing compensator. Before you joke that all the add-ons are "too much" don't bet against this bowling pin shooter. If these items didn't help, they wouldn't be there

Besides the thread patterns, choke tubes come in a variety of applications. Some are lead only, some steel only, and some will work with both. Many older shotgun barrels were made well before any thoughts of screw in choke tubes, and have barrel walls designed for lead shot and proper balance. For thin-walled barrels, Tru Choke makes a Thinwall choke tube system. You can often install the Thinwall tubes into a barrel where no other choke tube will work. The drawback is they are lead-shot-only tubes. The extra stress of steel shot may be too much for the thin tube and thin barrel walls. Choke tubes come extra-long for lighter patterns, more uniform patterns or both. You can even get tubes that have ports for recoil reduction. And as icing on

the cake, you can get choke tubes that are rifled, to improve accuracy with slugs. For the hunter who goes after deer in a shotgun-only area, a rifled choke tube and clamp-on iron or scope sight is an economical and efficient way to get more hunting done with one shotgun.

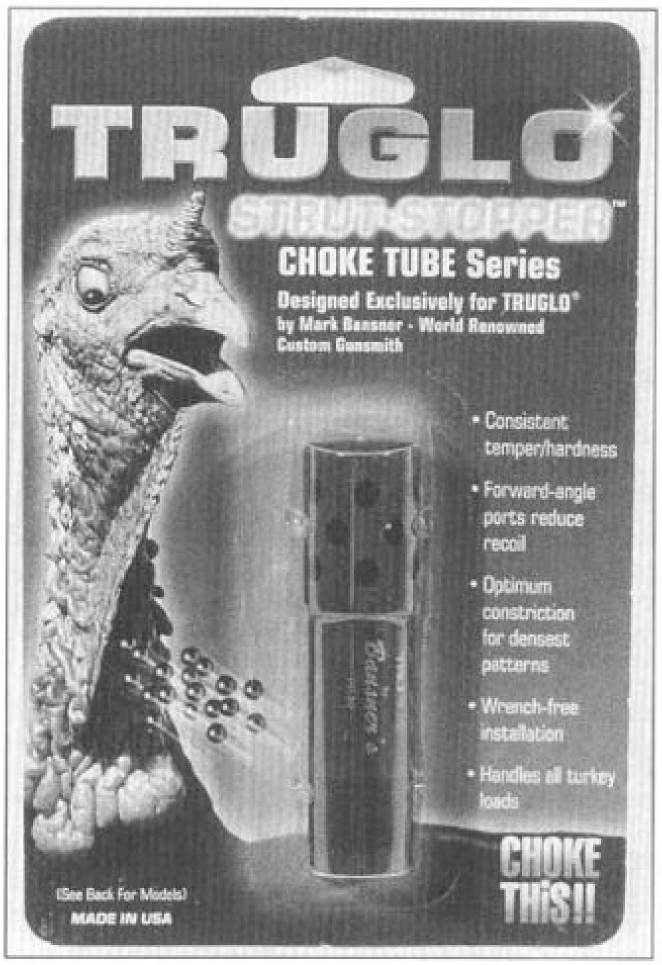


***Screw-in choke tubes are notched on the end to tell you which tube is which constriction*.**

Interchangeable Choke Installation

In order to install screw-in choke lubes in a barrel, you need measuring instruments. At the very least you need a dial caliper and barrel calipers. The barrel calipers allow you to reach into the bore and measure where your dial calipers won't reach. As with choke work, the bore calipers make the job faster and easier. Also, you must check for chrome-lined bores. As with the earlier choke reaming, the chrome will quickly dull your screw-in choke

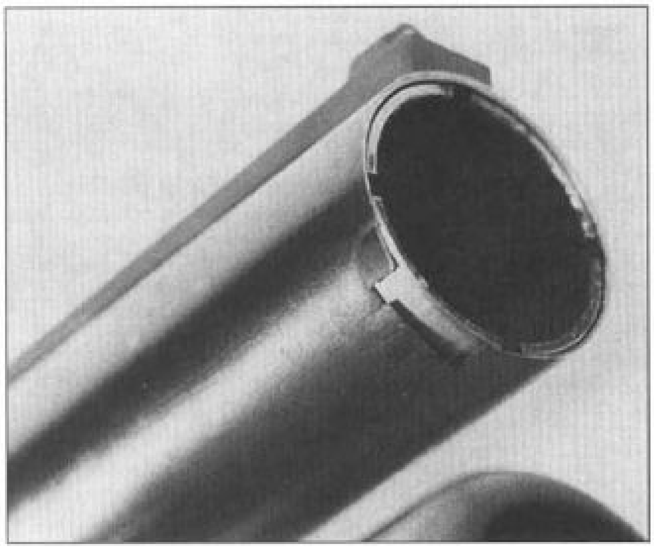
reamer unless you remove the chrome first. Once you have measured the barrel and determined that the choke tubes will fit properly, you need a choke tube reamer, a thread tap, and a bore guide bushing that fits your barrel. To ease the cutting and keep your reamer sharp you need a good cutting oil like Do-Drill from Brownells. The description of installing screw in chokes is simple. Ream the choke out. Ream the muzzle to the choke thread pattern. Tap the choke threads. The hard physical part is holding on to the barrel while all of this goes on, and keeping the reamer centered. The hard mathematical truth is that not all barrels made before choke tubes were common can have screw-in choke tubes installed.



If you are going to shoot turkey loads, you should use a choke tube made for the job. This one will deliver tight patterns and offers ports to reduce recoil.

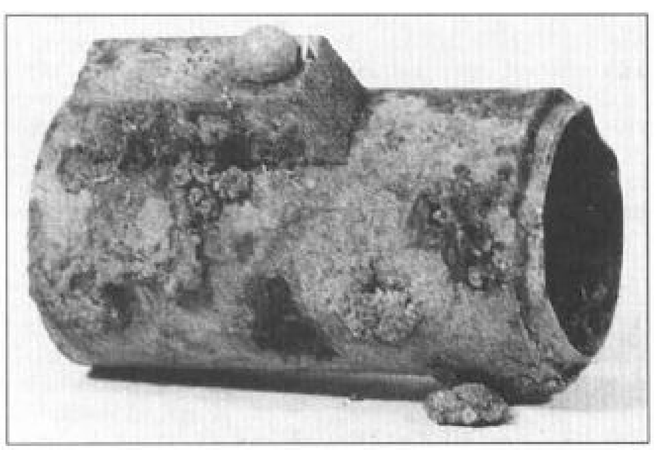
To determine if your barrel can be threaded, you must measure it inside and out. You have to determine the wall thickness left after reaming and threading, and the bore diameter for tube inner diameter compatibility. You must have an absolute minimum of .016″ wall thickness left on the choke portion of your barrel after reaming and threading. The bore diameter of your barrel must not be less than that of the choke tube itself. The minimums for each choke tube are: l2-gauge, .735″; 12-gauge Thinwall, .728″; 20-gauge, .624″.

Start by measuring the outer diameter of your barrel. Subtract from that the first measurement of the choke thread size. Divide by two. As an example, an old 12-gauge Remington Model 11 barrel brought in for threading measures .820.” Obviously, the Win and Rem chokes are too large. The Tru choke tube at .794″ leaves .026″, divided by two gives a wall thickness of .013″. Not enough. The Thinwall Tru choke leaves us with a wall thickness of .023″. This may work after all. Once you have done the math for average thickness, measure for point thickness. Not all bores are concentric to their exteriors. Use your dial calipers and measure the thickness of the existing barrel wall at the muzzle. Compare your measurements with the average thickness calculated. An off-center bore will have one of the measurements smaller than the other four. If you find your bore is off center, make additional measurements close to the smallest, and locate the thinnest section of wall. How much thinner is it than the average? Subtract that amount from your calculated choke tube wall thickness, and see if the result slips under the minimum. If the barrel still passes, continue. The Remington barrel is off center by .005″, bringing the net wall thickness at the thin side to .019″ not enough to bring it under minimum.



If you leave your barrel wall too thin, you'll end up like this. While this choke tube has lasted many thousands of rounds, you don't want your barrel to look like this. If the barrel is too thin, it is too thin. Don't install choke tubes.

What is the inside diameter of this Remington M-11 barrel? A disappointing .734″. Since the inside of the Thin wall tube is .728″, the rear edge of the tube will be sticking into the bore. If you install this tube and then shoot the barrel, the choke tube may become wedged in place, crack or blow off the end of the barrel. This particular barrel cannot be threaded for screw-in choke tubes. Resist the temptation to thread a barrel that “comes close” but doesn't quite measure up. You could damage the shotgun on firing it, and even hurt yourself.



***This barrel obviously was not up to the task. It came off and was found after the spring thaw. Too thin is too thin, so keep those barrel walls thick enough*.**

If your barrel passes all the measuring trials and has an appropriate wall thickness and bore diameter, then you can ream it (or have it reamed) for screw-in choke tubes. The best way to ream and thread a barrel is in a lathe. By holding the barrel firmly in the lathe chuck, you prevent wobble or misalignment. By adjusting the jaws of the lathe you can easily center the barrel. The problem is that most lathes are not large enough to hold barrels. There is no such thing as "close enough," either a lathe is big enough or it isn't.

Without a lathe, you have to start by hand. Use the expanding reamer you used to open up a choke, and follow the earlier procedure. Your stopping point is when the "choke" has the same diameter as the bore. You have removed the constriction, and provided a smooth and even diameter for the pilot bushing of the choke reamer.

The reaming for the choke tube can be done by hand, but is a lot of work. One method I worked up to avoid the labor of hand-reaming was to modify a centering holder for the reamer and use a drill press. The centering holder kept the reamer in line with the bore, following the pilot bushing. If you have a drill press that stands on the floor you can do the same. Bolt a vise to the table. Turn the table on its side. Use a layer of masking tape to protect the barrel, and clamp it in the vise. Adjust the vise on the table until it clamps the barrel on the centerline of the drill press. One method of centering the barrel is to put a drill bit in the chuck and lower it into the muzzle. Measure the gap between the drill and the barrel on four sides, and adjust until all four are equal. Once centered, raise the drill and swap the drill for the centering holder and reamer.

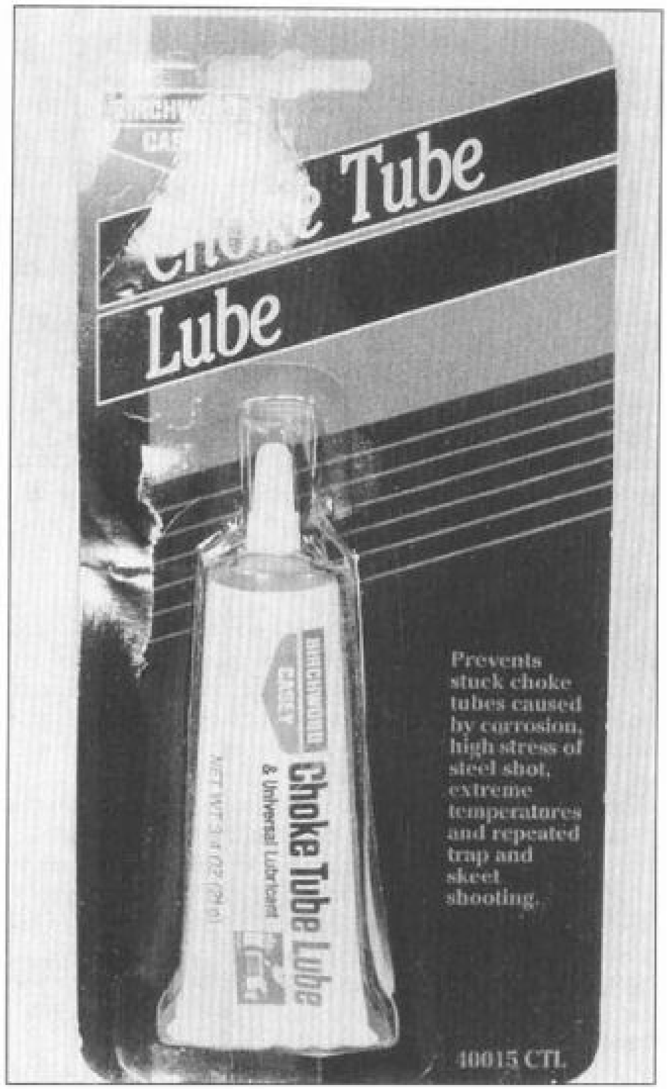
Lower the pilot into the bore and adjust the barrel so the drill press will have enough travel to ream the recess. Place a can under the barrel to catch the chips of steel and cutting oil. With a squeeze bottle apply Do-Drill to the reamer. Start at slow speed and gently lower it into the bore. Periodically raise the reamer out of the bore and brush the chips off. Once the shoulder of the reamer touches the muzzle and cuts the face of it square, raise the reamer and turn it off. With the recess reamed, I preferred to tap the threads by hand. Clamp the barrel in a padded vise with the muzzle up. Clamp the tap in a large tap handle and brush cutting oil on the tap. Gently lower the tap into the bore and once the cutting flutes reach the inner shoulder of the recess,

begin turning. Every three or four rotations stop and back the tap up half a turn to break the chips the tap creates. Once the shoulder of the tap reaches the muzzle edge stop and turn the tap out.

Brush the tap and reamer clean and put them away. Scrub the newly-tapped choke tube insert clean. Place a few drops of a synthetic oil in the barrel threads, and on a new choke tube of the same pattern. Gently install the choke tube. It may seem hesitant at first, but the edges of the new threads will still be slightly rough. Once the choke tube has been installed a few times the threads will smooth out a bit.

Screw-in Choke Tube Maintenance

Screw-in choke tubes seem miraculous, but they aren't. They are a manufactured product, and as such can be abused, neglected or loaned to your brother-in-law. The threads on the barrel and tube are designed to stand up to the stresses of constricting shot. There are some things they don't deal with well. One is dirt and gunk. Another is heavy-handed installation. The last is neglect and an incorrect payload.

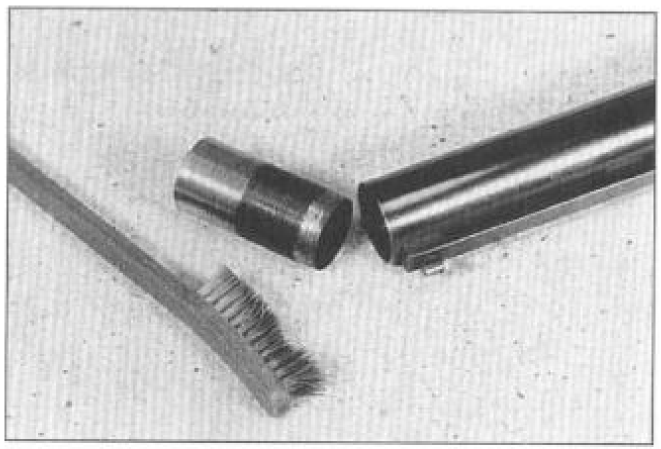


Proper choke tube maintenance means the right lubrication. Buy it, use it, and you won't regret it.

If you are going to settle on a single choke tube and never change it, then maintenance can be easy. Easy, that is, until you change your mind and try to remove it. Even if you plan to never change chokes, you should remove the choke tube as part of your cleaning and maintenance routine. To give your choke tubes the best service you'll need the usual solvents and lubricants, a choke tube wrench, and a choke tube thread cleaner. A brass-bristle brush will be a lot of help cleaning the tube. Those who want more assurance can use a special choke tube thread grease to ensure the tube doesn't get stuck in the future.

Without regular cleaning, choke tubes become increasingly difficult to remove, until taking the tube out becomes a major operation.

Your choke tube maintenance can be done as part of the barrel cleaning, or as part of an annual overall cleaning. With the shotgun unloaded and the barrel removed, unscrew the choke tube. Put a few drops of oil on the choke tube thread cleaner and screw it into the barrel. Then unscrew it and wipe it clean. For really dirty shotguns, or long-neglected ones, I then shoot the threads with an aerosol cleaner, then repeat the oil and thread cleaner step.



Scrub the threads of the tube and barrel, then lubricate and reinstall.

If you don't have a choke tube cleaner, then a stiff plastic-bristle brush will do to scrub the barrel threads clean.

The tube threads should be brushed clean with a plastic bristle brush. Then spray them with the aerosol cleaner and a few drops of a light lubricant. Break Free or FP-10 works well.

If your barrel has been shot extensively, the choke tube will have plastic built up inside of it. With the brass brush, scrub the plastic until it is gone.

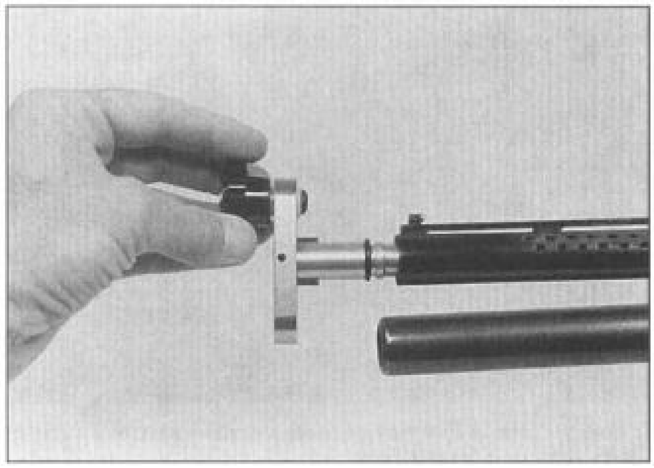
With barrel and tube clean and oiled, insert the choke tube into the muzzle and gently turn it until the threads catch. The threads are small and can be cross-threaded if you aren't careful. It should not be necessary to force the choke tube. If you have to use force, it is mis-aligned. Once the threads catch, then you can use your choke tube wrench to screw the tube all the way in. Once it bottoms out, it should be tightened finger tight. Do not use the leverage of the wrench to further tighten the choke tube.

Heavy-handed installation can also wedge a choke tube in place. While an overly-tightened tube can be wrestled out and will not suffer damage, a cross-threaded tube mangles the threads and can ruin the barrel. Always finger-start a choke tube and then use the wrench to turn it down into place.

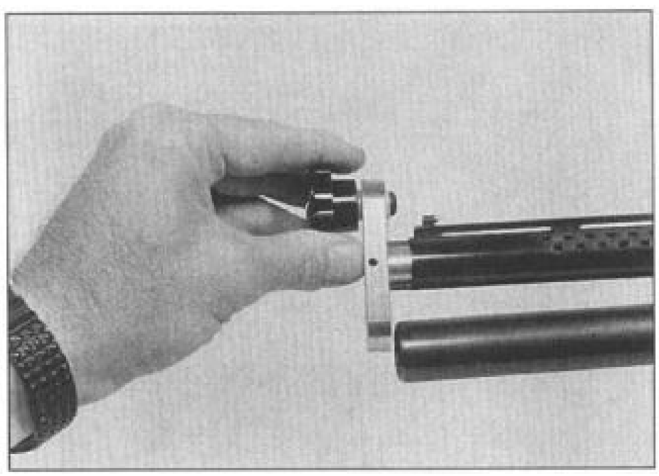
It doesn't take a box full of tools to clean and maintain a choke tube, but it might take a box full to correct the results of neglect.

If you use a wrench, you must use lubrication. Otherwise you might tighten the tube too tight, and not get it out.

Neglect and an incorrect pay load can cause the demise of a barrel. If your choke tubes are an early system that are not rated for steel shot, using steel shot can peen the tube and make it immovable. You can even shoot the tube off the end of the barrel. Letting your choke tube get packed with plastic residue, and then sending a large, hard and fast payload down it can peen the tube and make it immovable. Yes, we have all known of shooters at the club who don't take the Full tube out of their barrel, not even for slugs. Someday, sooner or later, they will go to take that tube out and be in for a surprise.



The wrench slides into the muzzle…



…then catches the stubs in the choke notches to remove it.

Stuck Choke Tubes

Sooner or later you will encounter a choke tube that resists removal. The causes are several, and the solutions few. Choke tubes can become stuck because the tube is bulged or cracked. Usually bulged or cracked tubes are from steel shot through a choke tube not meant for steel, or, a wad or clump of mud might be in the muzzle when it is fired. Often the barrel itself is damaged enough that removing the choke is impossible, or its removal

further damages the barrel. Another very bad reason for choke tubes being stuck is cross-threading. Unlike the bulged or cracked tube which is flush with the muzzle and appears to be OK, the cross-threaded tube is mostly hanging out. You should be delicate and gentle starting a choke tube. Once it is going, then you can use your fancy choke tube wrench with the ball-bearing handle.

In such extreme cases the only solution is to cut the barrel off and ream it, again, for screw-in choke tubes.

Less extreme causes of choke tube recalcitrance are over-tightening, dirt or powder residue or petrified oil. The stuck tube has to be coaxed free. Remove the barrel from the shotgun, and scrub the bore squeaky clean. Take an empty coffee can and fill it with 3 or 4 inches of penetrating oil. The more penetrating the better. With a heat gun or propane torch, gently heat the choke tube area of the muzzle. Heat it warm to the touch, but not hot enough to carbonized the oil or grease that might be between the tube and barrel. If you see oil bubble out of the choke tube joint, stop, you are too close to overheating it. Place the still-warm barrel muzzle down in the coffee can and let it sit there. The heat-and-soak routine is sometimes enough by itself to free a stuck tube. Soak the barrel overnight. The next day wipe it clean and clamp it in a padded vise. Try to unscrew the tube. If it won't come free, try heating and soaking it again. My experience has been that if a tube doesn't come free the first time, further soaking won't do much good. (You can try it. I've left barrels soaking, to no avail, for several weeks.)

The machinists trick of heating the exterior while using an aerosol freeze spray on the inside also doesn't work. I think the choke tube is too thin and the cold passes through the tube too quickly, into the barrel wall.

The solution is Brownells part number 080-826-012 (080-826-020 in 20-gauge). The stuck choke removal tool lets you wrestle a stuck choke tube out without harming the barrel, provided what has the tube stuck hasn't already harmed the barrel. After pulling a bunch of stuck tubes out, I found that the combination of soaking and then using the Brownells tool made a tough job easy. The tool is gentle enough on tubes that you can usually polish them up and re-use them. If they haven't been stretched past proper dimensions, that is.

Always use the proper choke tube for your barrel. Just because it "fits" doesn't mean it's right. (photo courtesy Browning Arms Co.)

To use it, loosen the tool until it is contracted enough to fit into the muzzle. Lower the tool until the rubber O-ring touches the muzzle. Tighten the screws to expand the tool until it bites into the choke tube. Grasp the handle and turn the tool. The choke tube will come free with a horrible screech or a loud snap. Once the choke tube has moved, loosen the tool and use a regular choke tube wrench to finish removing the tube. If you cannot use a regular choke tube wrench, and must use the tool to completely remove the tube, you have encountered your first sign of bad news.

With the tube out, use a brush and solvent, small-diameter wire wheel or choke tube thread chaser to clean the threads out. Scrub the threads of the choke tube clean.

With the tube out and everything clean, you must now determine if the tube, barrel, or both are damaged. Stuck tube removal problems resolve themselves into three likely endings. One, the tube and barrel are fine and just needed some cleaning. Two, the tube is damaged and won't fit back into

the barrel, even though a new tube works fine. Three, the tube and barrel are both damaged, and the barrel must be replaced, or cut off and re-choked. Take a different choke tube and attempt to install it. It should smoothly and evenly turn all the way in. It should fit snugly, without binding or looseness. If the new tube binds during installation, your barrel could be bulged in one spot. If the new tube wobbles, the bulge is an even one all around the barrel, and a new tube may not receive sufficient support to keep it from expanding and wedging in place.

If the new tube screws in fine, remove it and try the old one. If the old one screws in fine, you have escaped further problems. Your tube was probably over-lightened or had some grit or powder residue in the threads. If the old one won't fit, or fits lightly (tighter than a new tube) and requires a great deal of force to install, the tube is damaged.

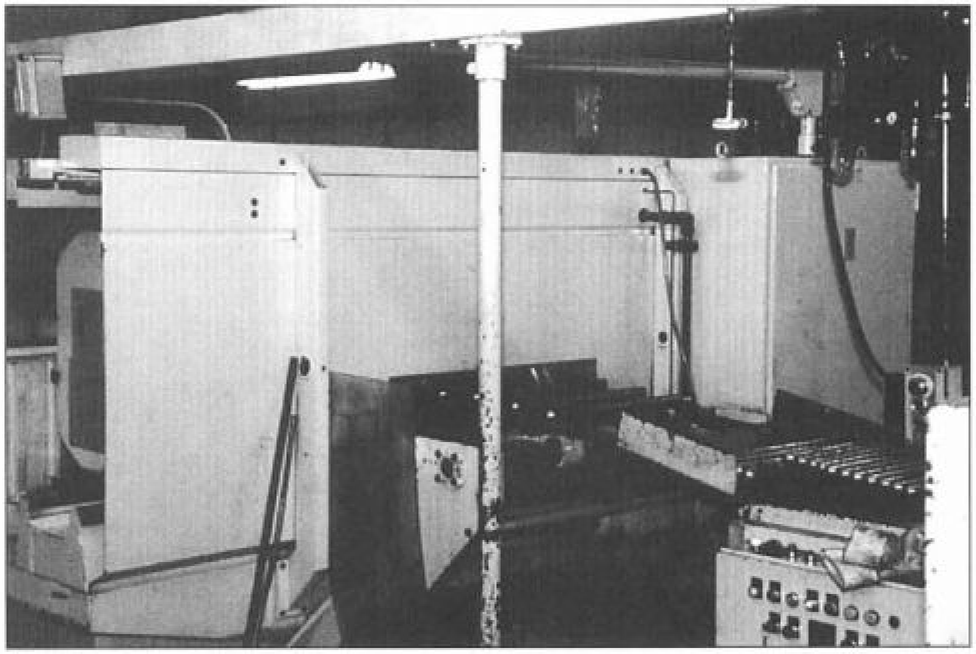
If the tube will not fit your barrel, scrap it. (The tube, not the barrel.) I used to save old tubes “in case” I found a use for them. Then one day I realized that someone at the shop might find the box of tubes and sell one because it was just what a customer needed. Rather than explain how a customer got a choke tube that didn't fit (and maybe was forced to fit) I took a hammer and flattened them. I didn't need the hassles, and neither do you. In haste, you might mistakenly install the tube, and have to wrestle it out again. Choke tubes are cheap enough, scrap the ill-fitting one.

Chapter 7

Chamber, Forcing Cone and Bore

Every firearm has to have a barrel. The production of steel underwent a revolution after the American Civil War. New processes for producing high-quality steel accurately alloyed with known amounts of hardening or toughening metals became available. The best-known of these was the Bessemer Process, where purified oxygen was blown through the crucible full of molten iron. When steel and iron were produced in small lots, a gunmaker could justify the cost and labor of making a Damascus barrel. For speed of production, arsenals could make barrels by rolling and welding a long plate into a tube. When steel mills could provide high quality and uniform bars of steel in large quantity, why make barrels from scratch? The trick was in turning the bar into a tube.

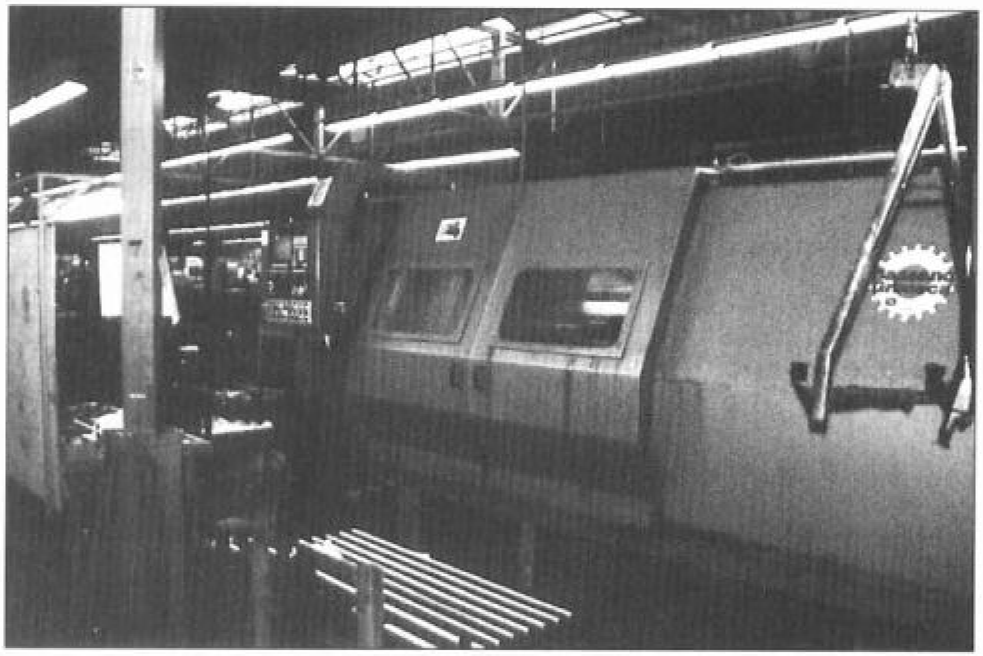
The method used then and now is simple in concept, and difficult in practice. You drill the center out. The technical difficulties are many and not easily overcome. How to keep the drill straight? How to remove the chips and cool the drill? Which do you spin, the drill or the bar? You keep the drill straight with a large-diameter and stiff shaft that doesn't bend. The chips are removed and the drill cooled by making the drill hollow and pumping lubricant through it. And the drill stays still and the bar spins. Once the bar is drilled and reamed the outside is turned to its final diameter. If the barrel will have a rib, the rib is fastened at the same time any barrel hangers are attached. The barrel hangers can be a simple hoop like on the Remington 870, or a stud that holds the fastening nut like the Mossberg 500 or Ithaca M-37. Or, it can be the combined magazine hoop and gas system like the Remington 1100 or 11-87, The rib and hanger are wired to the barrel while held in fixtures. The barrel is then sent through an oven that heats it up to the melting point of the solder, and when it cools the parts are secured. The wire is then removed and the barrels sent on their way for chambering, choke reaming and gas port drilling if needed. How do they get the solder in between the barrel and parts if the barrel is in an oven? Ssh, it's a secret. Each factory has their own method, and none are keen about talking about it.



This barrel-turning machine at the FN plant in Belgium turns out ready-to-drill barrel blanks at an impressive rate.

On doubles, not only does the manufacturer have to go through the process twice, once for each barrel, but then he has to solder the two tubes together so they are pointing to the same spot. Much of the high cost of British side-by-side shotguns was a result of doing everything but the initial drilling by hand.

One thing you should know about drilling barrels is the wandering bore. To minimize the drills chance to wander, the bars are drilled from the ends and the holes meet in the middle. Any misalignment is removed when the initial drilled hole is reamed larger to its final inner diameter. Despite their best efforts, the barrel maker cannot guarantee that the bore will be exactly centered in the middle of the barrel. I have shortened quite a few shotgun barrels through the years, and found that many are off-center where they have been cut. The off-center bore does not matter when it is in the middle, as the shot exits at the muzzle. A shortened barrel with an off-center bore can still have its pattern centered. What it may be difficult to do is ream the shortened barrel for screw-in chokes.



The automated barrel boring machine turns bars into tubes as fast as the operator can feed bars in and pull tubes out.

What to do if you shortened a damaged barrel with the intention of installing screw-in chokes, and find the bore off-center? If the thinnest wall is still thick enough for the screw-in choke system you will be using, go ahead. If the wall is too thin, you'll either have to use a thin-wall screw-in choke system (i.e. buy new reamers and thread cutters) or send it off to a gunsmith who has the thin-wall screw-in choke tooling.

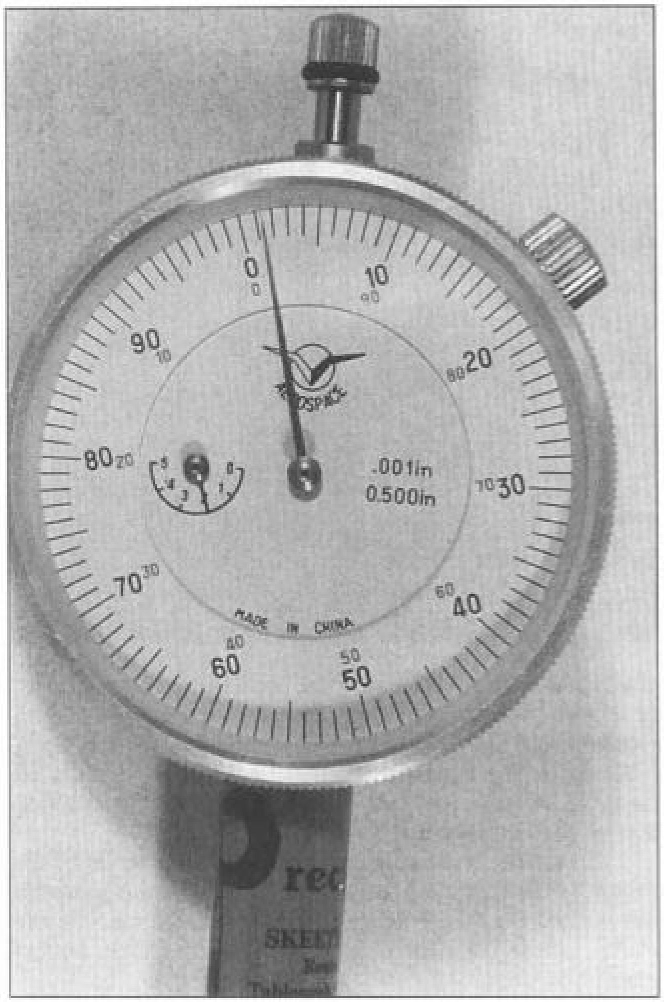
All the effort of making the outside of the barrel conform to expected appearances, or adjust the balance as British gunmakers do, is wasted if the bore won't perform. What do we expect out of a barrel? A good barrel will accept clean and properly-loaded ammunition without hesitation. The fired shot load should travel the bore without deforming the pellets or depositing too much powder and plastic in the bore. The shot should exit the bore and arrive at a known distance having spread a known amount. The pattern should be delivered to the same location whether the barrel is hot or cold, clean or dirty. The empty hull should cleanly and easily be extracted or ejected from the chamber, and not be so swollen from firing that it can't be reloaded.

The barrels have their gas system hangers and ribs wired on and then soldered in place.

Once having been fired, an ideal barrel wouldn't need cleaning. What we will settle for is a barrel that cleans easily and resists rust when clean or dirty.

In short, the ideal and realistic shotgun bore would be the one owned by the mama bear. The chamber will be big enough but not too big, the bore will be uniform and smooth, the choke will be the right size and deliver the correct performance you want.

Unlike handguns or rifles, the shotgun does not have rifling to spin the projectile. Yes, there are rifled shotgun barrels, but ignore those for the moment. The shotgun barrel has the same components as rifle or handgun barrels, but the downfall of the shotgun for many years was the fact that the dimensions were not as critical. In a rifle, if the bore is not reamed and polished to a certain dimension plus or minus a half a thousandth of an inch, accuracy will suffer. Sometimes greatly suffer. A shotgun barrel bored plus or minus five thousandths used to be one made to strict specifications. Between manufacturers, barrels would vary 20 or 30 thousandths. The manufacturers of shotgun shells knew this and made their ammunition to work in any barrel. After all, the purpose of a shotgun is to throw a cloud of shot into the air, right? Who needs precision?



You need a precision bore measuring gauge to measure chamber, forcing cone, bore and choke.

Manufacturing specifications have tightened up, but there is still room for variance. And room for improvement. After all, all those old shotguns out there have to be brought up to date.

If you have an older shotgun, your barrel probably is causing you harder recoil and less-uniform patterns. With some judicious adjusting and polishing you can decrease the kick you get, and make your patterns more uniform.

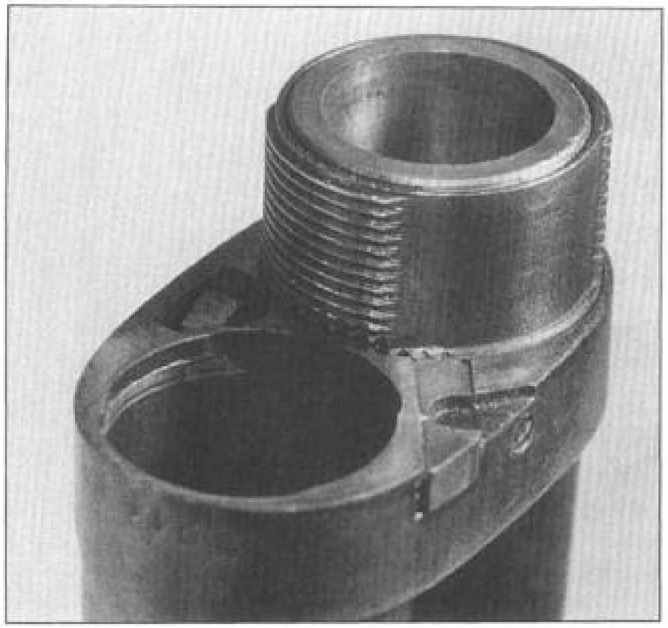
When you work up enough nerve to start filing or cutting on your one and only shotgun, you may find the work going slowly. After all, if you mess something up you have to get another shotgun, right? You can quiet your nerves and solve the problem by getting the second shotgun first. That is, a

practice gun. Go to the local gun show and buy an inexpensive used pump shotgun. If you live where buying another gun just for practice is an onerous chore, then don't buy the whole thing, just buy what you need. In the case of the stock-working chapter, buy a stock. For this chapter, buy a barrel. Practice on the one you just got. Once you have a feel for how things go, then work on your main gun. Professional gunsmiths have an advantage in that they see many guns go by, and can offer to buy some just for practice. I bought quite a few shotguns that were beyond repair just so I could practice or experiment on some aspect of them. Once they were experimented to nothing, I marked in my bound book that they had been destroyed or turned over to the State Police.

With a practice barrel you can cut and polish to your heart's content until you feel up to working on the family heirloom.

The chamber is the recess in the rear of the barrel where the shell rests before firing. Once the barrel has been formed, reamed and polished, the chamber is reamed. As with all manufactured products, the chamber must fit between two dimensions. The minimum size of the chamber is slightly larger than the largest shell size, while the largest chamber size is the greatest the chamber can safely be and still fire the smallest allowed shell size without a problem.

Standard 2-¾-inch chambers came about between the wars. Many are short or rough even when marked "2-¾.".



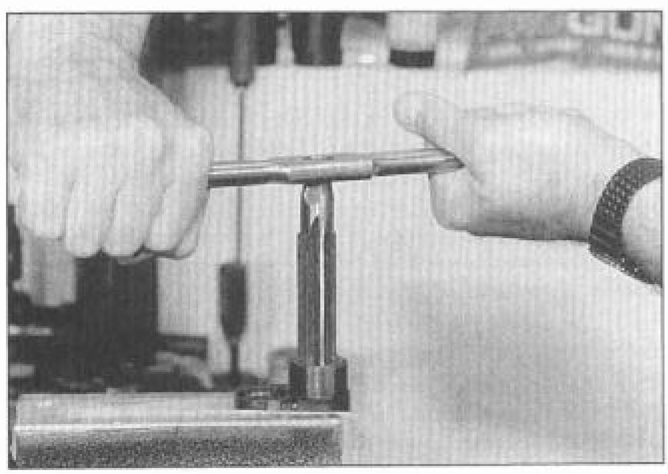
The Winchester M-97, like many early takedown designs, takes the barrel off halfway through the chamber. It makes lengthening the forcing cone easier to do but harder to measure.

The reamer starts out made to the largest size. As it wears and is sharpened, the chamber it cuts gets smaller and smaller. Remember, the reamer at the factory is cutting hundreds of chambers a day. It will wear down. As long as the reamer is cutting a chamber larger than the smallest dimension, it is kept in service. Once it slips below minimum, it is replaced. What if your barrel was the last one cut before the reamer was replaced? Your chamber, in addition to being small, will probably be rough. The smaller chamber increases chamber pressure, and the roughness makes extraction more difficult. The rough chamber is more difficult to keep clean, and the buildup of powder residue, plastic and other gunk makes the chamber even smaller, increasing pressure.

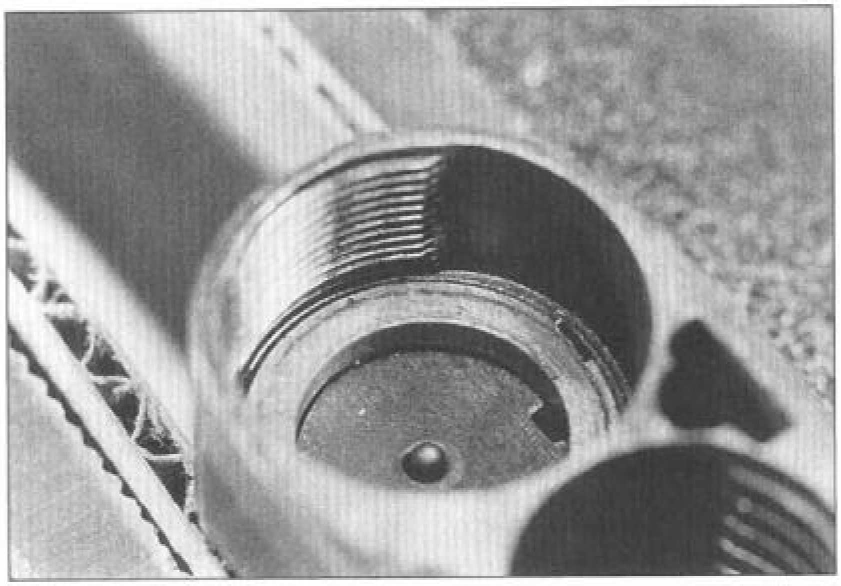
And then there is the taper. The chamber is supposed to be cylindrical, but the reamer may have worn unevenly. The leading edge of it would be doing more work than the rest of the reamer, and the front half of the reamer body would wear more than the rear. Your chamber could be tighter at the front

than it is at the rear. This is yet another factor to increase pressure. Increased pressure is not good. Your shotgun was only designed for so much pressure, and more does not help. Extra pressure wears the mechanism and kicks you harder. Any minute increase in velocity is not worth it.

You might think that all these difficulties are a sign of sloppy manufacturing. You are wrong. The manufacturers have stringent standards they stick to, and the differences we are talking about are small. For the factory to go over every barrel and make sure it is exactly the optimum size and smoothly polished would add greatly to the cost of each barrel. At a time when many shooters feel that a basic pump shotgun that costs less than $300 is practically a birthright, adding another $30 or $40 to the production cost of each barrel would be economic suicide. Or, a great marketing campaign for a simple pump shotgun intended to sell for $700.

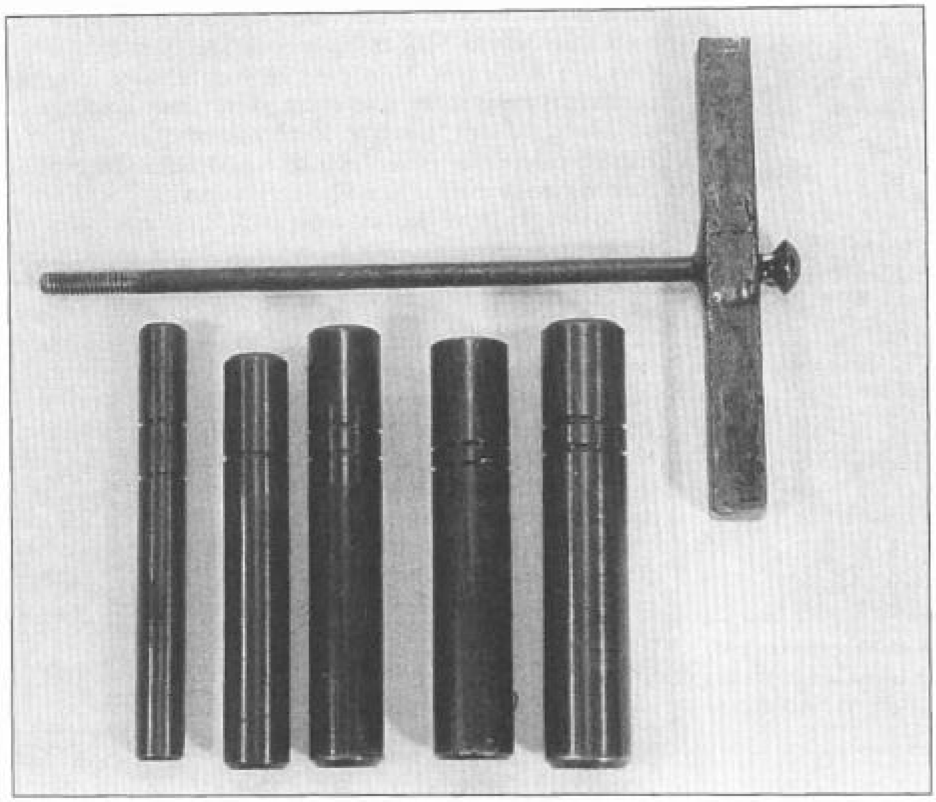


To ream a chamber you need a chamber reamer, a large tap handle and cutting oil.



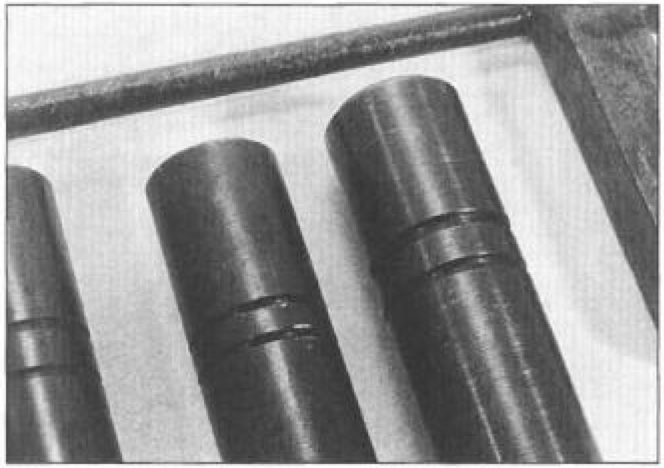
The stop ring inside the receiver is the surface the rear of the barrel bears against. Your chamber length measurement is the total of the chamber in the barrel, and the ring-to-bolt measurement.

First, you have to measure your chamber. The best investment I made when I started out was getting a set of chamber gauges from Brownells. With them I was able to determine if a chamber was the right size. Without them I was, and you will be, guessing. The gauges are precision-ground cylinders with a front edge of the maximum chamber dimension. At the rear are one or two grooves turned into the surface. The grooves indicate the correct length.

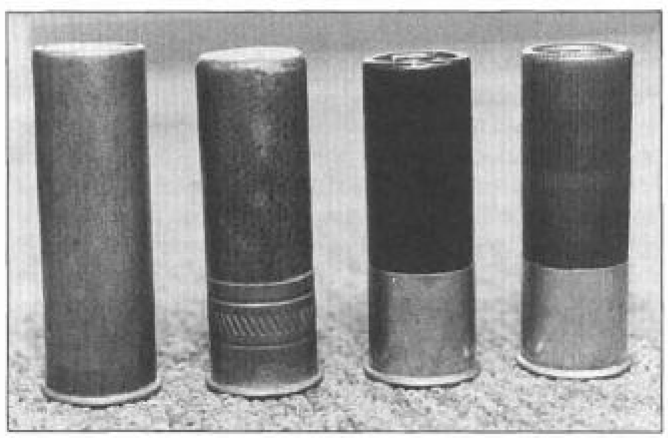


You'll also need chamber measuring gauges and a handle to insert and remove them.

Today's chambers are supposed to be cut to known lengths, but earlier shotguns may offer you a surprise. Currently, 12-gauge chambers (and shells) come in 2-¾-inch, 3-and 3-½-inch lengths. Before the lengths were standardized, chambers and shells would come in other lengths. It is not uncommon to encounter an old shotgun with a 2-⅝-inch chamber, while the British were fond of 2-½-inch or shorter hulls. You cannot use the shell as a measuring gauge. The length of the chamber is meant to accommodate the unfolded hull. A loaded shell is shorter because of the folded crimp. A loaded 3-inch shell will fit into a 2-¾-inch chamber, which is a dangerous situation. In such a mis-match when the shell is fired, the crimp will attempt to unfold, and find the forcing cone in the way. Unable to fully unfold, the crimp petals will be in the way as the pay load attempts to go down the bore, greatly increasing pressures. DO NOT use a loaded cartridge as a measuring gauge. Buy the right gauge.



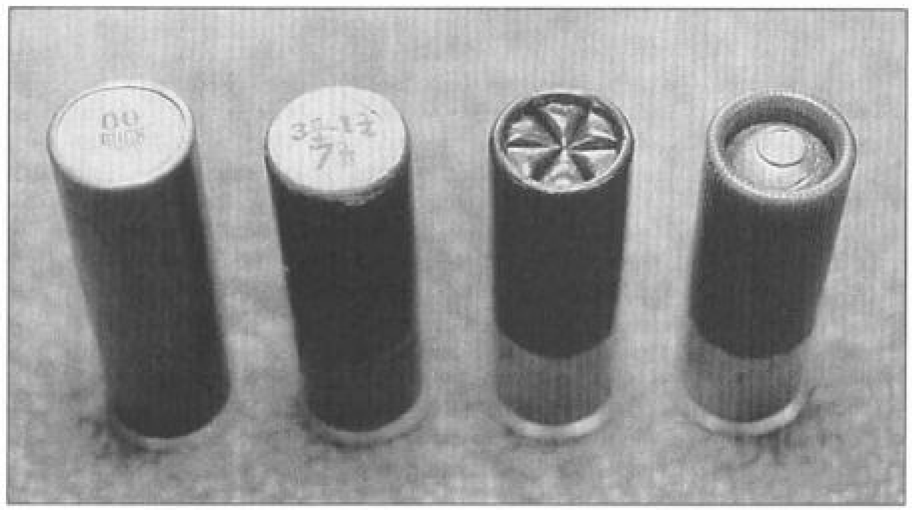
The chamber gauges have grooves as length markers. The lower one is 2- ¾ inches, and the top one is for 3-inch chambers.



All four are 2- ¾-inch shells. The all-brass one will not extend when it opens, and thus is longer loaded than the others. The early paper shells would swell when wet, making brass popular even though it was more expensive.

To check your chamber, unload the shotgun, scrub the bore and clamp the barrel in a padded vise. I built a handle to insert and remove my gauges. The handle is just a long bolt with a section of ¼-inch × 20 thread. I also filed a bevel on one side of the rear of the gauge to clear the ejector of Browning A-5 and Remington Model 11 shotguns. Gently lower your gauge into the chamber until it stops. Look at the groove on the rear of the gauge.

Does it reach the rear of the chamber? If not, your chamber may be a bit short. When the gauge reached bottom, did it stop as if hitting a shelf? Or did it feel like you were pressing it into a funnel? If you have the funnel feeling, the chamber may not be short, but be so tight at the front that the gauge cannot go fully forward.

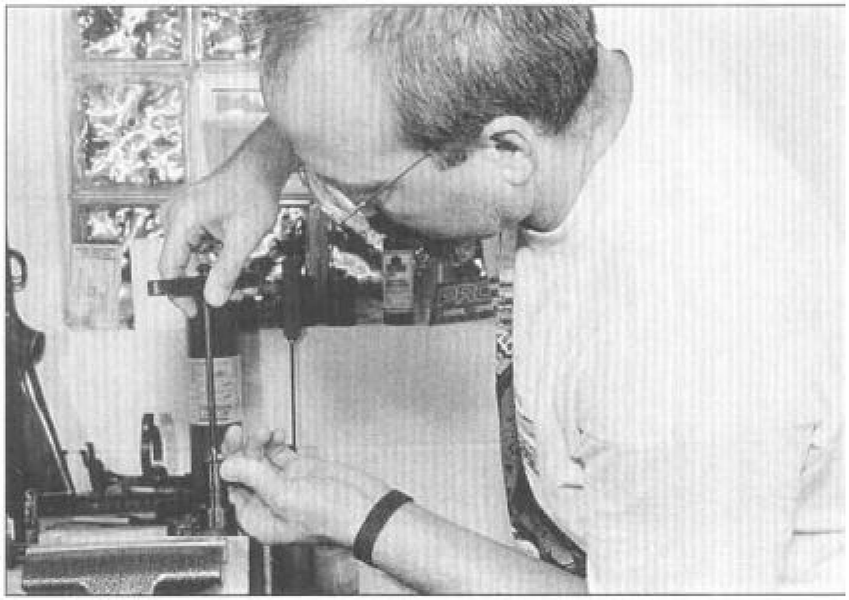


The brass hulls and paper rolled crimp hulls use a paper card to close them. The folded crimp uses the end of the shell. The slug is rolled and left open to make it obvious what it is.

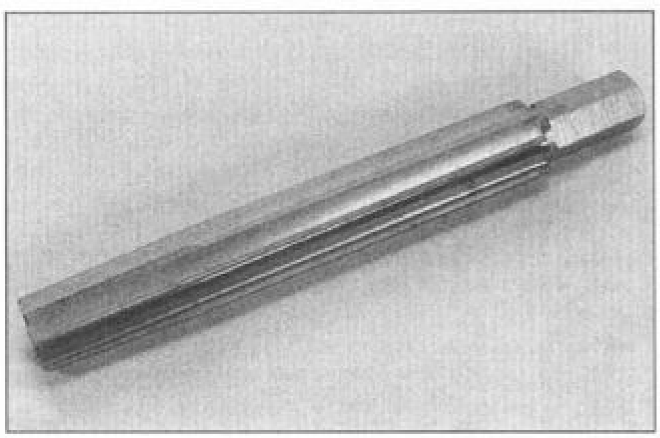
Before you go and ream the chamber, consider the barrel. While reaming the chamber on an American-made repeating shotgun made in the 20th or 21st century is no problem, other barrels might pose a problem, especially barrels on a tight-weight double from Europe. Light-weight doubles, whether British or Spanish, have their balance adjusted and their weight lightened by hand-filing and tapering the barrels. The barrel may taper so quickly in front of the chamber that deepening the chamber even slightly could make the barrel walls too thin. On any double-barrel shotgun besides a Savage/Stevens 311, have a professional gunsmith measure the chamber wall thickness at the front of your chamber before you ream. Do not lengthen the chamber beyond the intended length. Don't even think about taking a 2- ¾-inch double and reaming it to a 3-inch chamber. Don't do it on a pump or auto, for that matter. Single-shots? Don't do those, either. What's

left? Nothing. There are no guns on which you can safely lengthen the chamber. Don't do it.

To ream the chamber you need a chamber reamer, a large tap handle, cutting oil, and a barrel hone. Instead of a chamber-only reamer, buy a long forcing cone reamer and do both the chamber and forcing cone together. (More on the forcing cone in a bit.) **NOTE: Read the section on the forcing cone before you start reaming the chamber**. Clamp the barrel so it is vertical with the chamber up and place a small can under the muzzle. Brush some cutting oil on your reamer and slide it down into the chamber. Turn it while pressing down gently until the reamer bites the steel. The amount of pressure you will need will vary, and must be learned by doing. If you do not press hard enough the reamer will not bite. It will slide over the surface, and probably dull quickly. If you lean on the handle too hard, the reamer will bite too deeply and stop turning. The only way I can describe it is when the reamer is cutting properly it makes a smooth grating sound. The force you will need will differ from barrel to barrel depending on the manufacturer's alloy and heat-treatment. Rotate the reamer twice, then pull it out. Unlike a tap, you do not want to turn the reamer backwards. It serves no purpose, and may dull the reamer. Brush the reamer clean, brush the chamber out and check with the chamber gauge. When you look inside you can see the freshly-cut surface of the steel. In addition to the front of the chamber, you will probably see the sides of the chamber have been cut. In addition to making your chamber the correct length you are turning it more cylindrical and even.



Insert the chamber gauge without forcing it until it stops. Compare the grooves to the extractor rim. A short chamber will leave the groove out of the chamber.



A forcing cone lengthening reamer can also be used to clean up the chamber and adjust chamber length.

Continue reaming and checking until the gauge rests in the chamber with the front edge of the groove reaching the rear of the chamber. Scrub the chamber clean and get out your barrel hone. Reposition the barrel to be horizontal in the vise. Put some lubricating oil in the chamber. Place the

barrel hone in the chamber and turn it on. Push the hone back and forth in the chamber. Stop the hone and pull it out. Wipe the chamber clean.

Clamp the barrel in a padded vise forward of the chamber, with the barrel vertical.

When you turn the chamber or forcing cone reamer, use both hands, even pressure, and let the reamer do the cutting.

The Forcing Cone

Just in front of the chamber lies the forcing cone. It is the taper from the chamber to the bore. Forcing cone design used to be different because of cartridge design. Old shotgun shells used a cardboard cap over the shot, and the lip of the hull was rolled over to contain the “shot wad” or “overshot wad.” Early shotgunners were very worried about this cardboard disk tipping and interfering with the flow of the shot through the forcing cone

and down the bore. To keep the card perched on top of the shot, the forcing cone was made short and steep. The invention of the one-piece plastic wad made the short and steep forcing cone unnecessary. A longer and more gentle forcing cone is easier on the shot. With a less abrupt transition from hull to bore, less shot is deformed. Fewer flattened pellets means more stay in the pattern and your pattern is more uniform. The abrupt forcing cone also increases recoil. The steep forcing cone causes the shot load to hesitate at the forcing cone, leading to a slight increase in pressure and recoil.

Unload your shotgun and remove the barrel. Look into the chamber end. Right in front of the chamber you will see a dark band. No matter how much you scrub it, a short and steep forcing cone will collect powder residue and plastic faster than a longer one. The build-up increases pressure and the number of deformed pellets. Also, the build-up provides a good hiding place for moisture, leading to rust. Rust in the forcing cone leads to… you guessed it, recoil and deformed pellets.

As with chamber reaming, you'll need a long forcing cone reamer, tap handle and cutting oil and your barrel hone. You will find the chamber gauge useful. However, if all you are interested in is lengthening the forcing cone, you can do the job without the chamber gauge. I found the peace of mind of checking with the chamber gauge was worth the small additional cost. If you haven't already, scrub the bore clean. Clamp the barrel in a padded vise with the muzzle down and a small can underneath to collect cuttings and oil. With your reamer in the tap handle, brush some cutting oil on the flutes and lower it into the chamber. Once it touches, press lightly and begin turning. As with the chamber reaming you'll have to adjust your pressure until the reamer is cutting smoothly and evenly. After two rotations, pull the reamer out and brush the flutes off. Look inside the chamber. Swab the bore if you have to. You will see that the dark band of the forcing cone has a shiny ring right in from of it. As you continue cutting and checking, you will see the shiny band expand forwards and back, gradually consuming the dark band. When the shiny band (your new forcing cone) has reached the rear edge of the old forcing cone and removed all traces of it, you are done. Periodically check with the chamber gauge if you want, but the chamber gauge will not show any change in the chamber length until the old forcing cone has been entirely removed.

Once the old forcing cone is gone, move the barrel to horizontal and use the barrel hone to polish the chamber and forcing cone. Scrub clean and

enjoy shooting.

Polishing

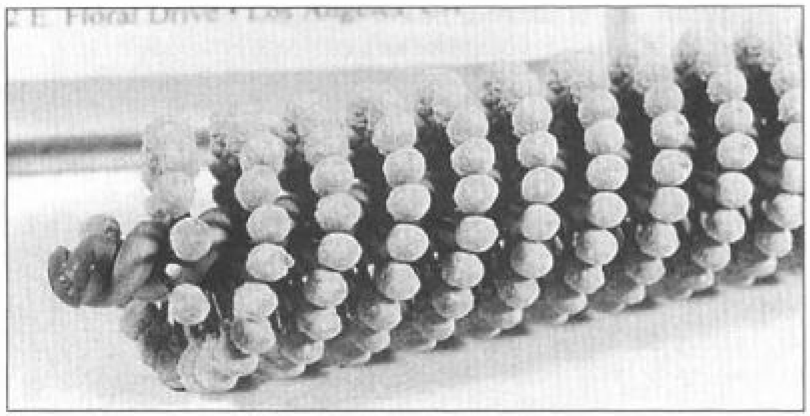
In addition to the chamber and forcing cone being rough, the bore itself can be rough. Even a bore that started life smooth can get rough over time. If a patch of powder or plastic fouling isn't thoroughly scrubbed off, it can attract and hold moisture. The moisture can rust the steel, etching it. Gradual oxidation of the steel surface can roughen it. Looking down a bore you'd think it was shiny and smooth. The angle you are viewing the bore at can be deceptive. You have all driven on a rough asphalt road, facing the sun. The reflection of the sunlight off the road can be blinding. It might lead you to believe that the road was a mirror. And yet, as you drive over it you feel every bump and pothole. Your bore could be the same way. I have used a bore scope on shotgun bores that had been meticulously cared for by their owners, and the sight was not pretty. Even with good cleaning there were streaks of lead, plastic and powder. The bores had scratches along the surface, and occasional spots of rust. After years of use, the only way to get the surface truly clean and smooth again will be by polishing. There are three methods of polishing a bore. The first is the old “rag on a stick” method, the second is the barrel hone and extension rods, and the third is Brownells Polishing Flex Hone.

The advantages to the polishing cloth and wooden rod method are low cost and choice in grit. The method is simple: take a section of dowel long enough to reach down the rod. A three-foot section of ⅜-inch dowel from the local hardware store will work well, or an old shotgun cleaning rod. Use a fine saw to cut a two-inch slot in one end of it. Cut a strip of polishing cloth or abrasive and slide it into the slot. You need to cut a piece long enough to be a bore-filling wrap without binding. Too short and the cloth falls off. Too long and you can't fit it through the bore. Clamp the other end of the rod in your variable-speed drill. Apply lubricating oil to the cloth and bore, turn on the drill and polish the bore. A good starting choice for grit on a used bore would be a 320-or 400-grit. To finish the job, or polish a new barrel, use 600 grit. Once done, swab the bore clean with oiled and dry patches and then leave the bore oiled when you store the gun.

The drawback to the stick method is keeping the cloth in the slot on the stick. If you push the rod too quickly forward or back, the cloth will slip and come out of the slot.

The barrel hone does not suffer from loss of its cutting surfaces. What it suffers from is length, or lack of it. The barrel hone can only reach 8 inches or so into your barrel. In order to polish the full length, you need an extension rod. I made mine from a section of aluminum cleaning rod. I bored out the front end to slip over the shaft of the barrel hone, and then drilled through the shaft and extension rod for a locking pin. On the rear, I turned the end down until it would fit into my variable-speed drill. In use it is simple. Clamp the barrel horizontally. Spray lubricating or cutting oil into the bore, insert the hone and turn it on. Run the hone forward and back until the bore is polished. Once done, swab the bore clean. With an extension rod, the only disadvantage to the barrel hone is the lack of choice in polishing grit. You have only the one type of polishing feet, and no others.

The Flex-hone is an easy way to polish a bore. It requires its own lubricating oil.



If you use the wrong oil, you'll break down the polishing knobs and ruin the brush.

The Brownells Flex Hone is the fastest and the best method for polishing your bore. As with all things convenient, it costs more. It also has the slight drawback of requiring its own special oil for cutting. If you try to get cheap or in a hurry and substitute some other oil you will find your hone disintegrating as you use it. A bad show old chap, and you'll have to buy a new hone. The flex hone is a flexible shaft with a number of small abrasive balls attached to the head. The flexible shaft makes it easy to reach down into the barrel, and the rotating head automatically finds the center of the bore. The flex hone comes in two grits: medium and fine. The medium quickly revives a tired bore, readying it for the fine polish. The fine polish brings it to a mirror finish. For brand-new shotguns, all you need is the fine grit.

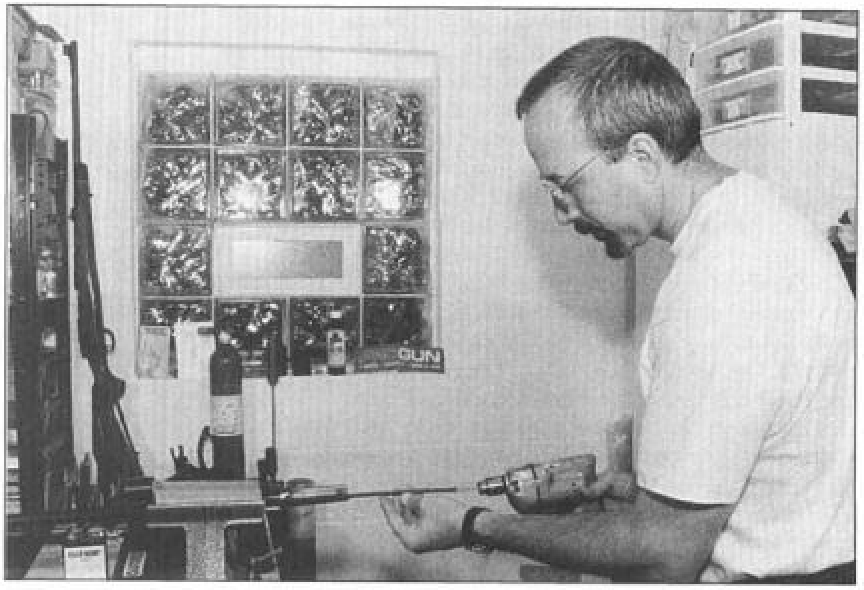
Clamp your barrel in a padded vise with the muzzle slightly down. Place a can under the muzzle to collect the dripping oil. Wet a patch with the special cutting oil for the Flex Hone, and run it through the bore. Start the Flex Hone (mounted in your variable speed drill) into the chamber, and squirt more of the cutting oil onto the abrasive. Start the drill at a slow to moderate speed, and push it the length of the bore. Do not let it poke out of the muzzle. Work the Flex Hone the length of the barrel two or three times, and then pull it to the chamber. Stop the drill, and remove the Flex Hone. Swab the bore clean and inspect it. If you feel the need, do this once with the medium grit and once again with the fine grit. If you do not have an

extension for the Flex Hone shaft, polish the rear half of the barrel from the chamber, and the front half from the muzzle. When you're done, wipe the shaft clean, wrap plastic or place a plastic bag over the polishing head, and store where it can't get something heavy set on it.

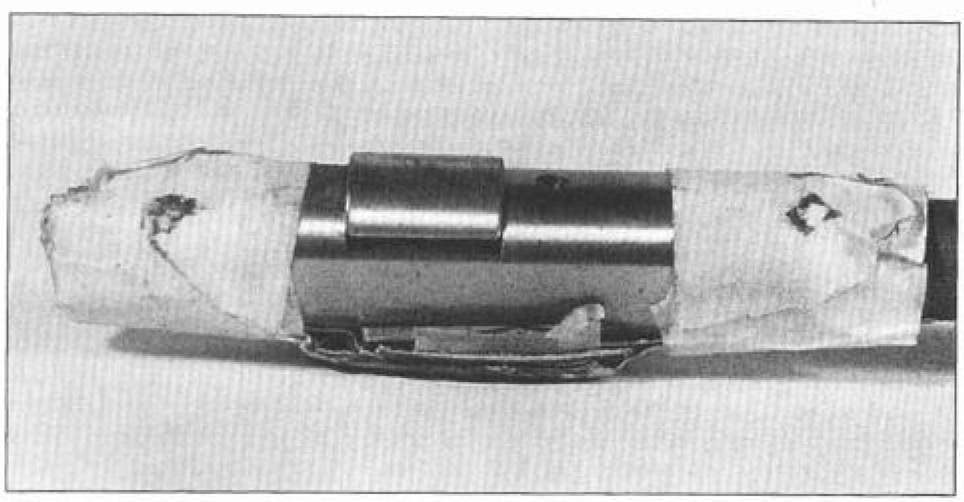
Barrels

You have to be careful with a shotgun. The barrel walls are not as thick as they are on a rifle, and the barrel can easily be dented. You can inadvertently dent a barrel by banging it against the frame of your duck blind, by swinging after a bird and hitting a tree, or standing it against the truck and then watching it topple after someone opens a door.

To lift a dent you have to get inside the bore. The traditional old method of lifting dents was with a tapered plug that you would drive through the bore. When faced with the first job of lifting a dent, I tried it. I deliberately dented a practice barrel (I had a drawer full of scrapped barrels for practice) and set about making a plug on my lathe. What I found was: The plugs had to be highly polished or they would scratch the bore. Even highly polished, if the bore wasn't scrupulously clean, the bore would get scratched. They had to be hard or they would deform and not fully lift the dent. They had to be just the right size or they wouldn't lift all of the dent. Faced with the prospect of making a dozen plugs each .005” larger than the last, I bought the hydraulic dent raiser. For those of you without a lathe, the choice is not an easy one. You can't make the plugs, and the hydraulic lifter costs more than a barrel.



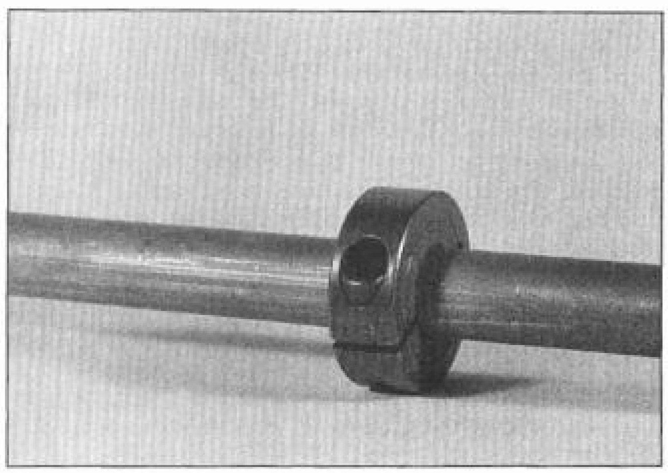
Use a variable-speed drill, a low speed and plenty of oil when polishing your bore.



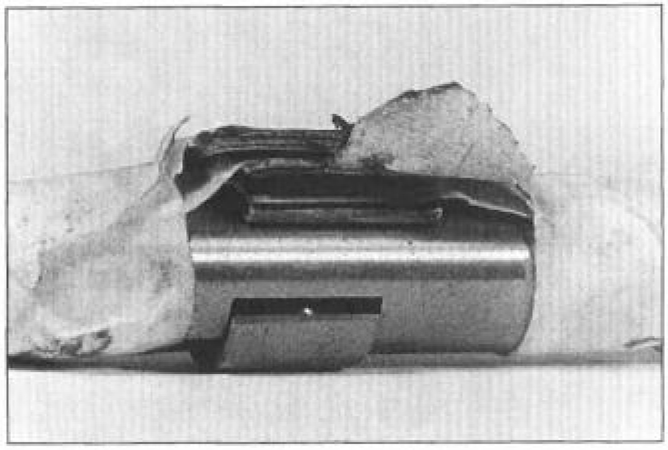
The hydraulic dent lifter has a pad that rises to press dents out of the barrel.

It may be the case that you simply take your barrel to a gunsmith who has a lifter, and pay him to lift the dent. For those who want to invest in the lifter, or are interested in how the hydraulics work, here is the procedure.

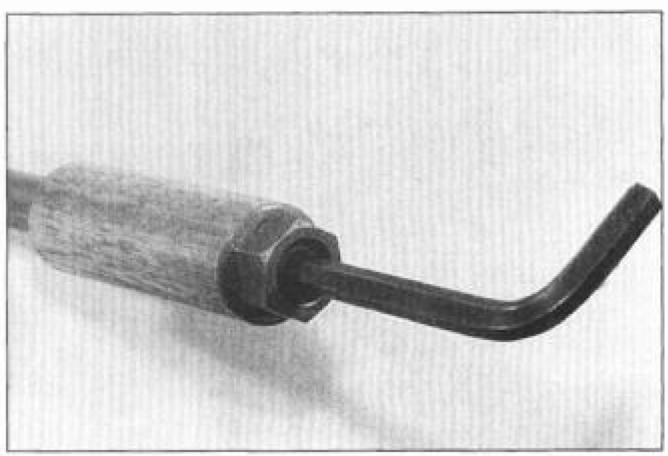
On the outside of the barrel, mark the dent. Take the lifter and mark the handle with a magic marker in line with the lifting pad of the hydraulic head. The lifter has a locking collar on the handle. Hold the lifter next to the barrel and slide the collar until it stops at the muzzle or breach, depending on which direction you'll be working from. The collar stops the lifting pad at the dent, so a minute or two spent getting the collar just right pays off. Lock the collar in place. On the rear of the handle is the expansion bolt. Run the bolt out and press the lifting pad down with a thumb until it will fit into the barrel. Scrub the bore squeaky clean. Run an oily patch down the bore. Clamp the barrel in a padded vise with the dent in view. Slide the hydraulic lifter into the bore and line up the handle mark with the dent. Use the allen wrench to tighten the expansion bolt. When the lifting pad contacts the dent, the bolt will become more difficult to turn.



The dent lifter has a stop ring that lets you position the lifter at the right spot to lift your dent.



To lift a dent in a magazine tube with the lifter, you'll have to add spacers behind the pad to increase the dent raiser's diamete.



The large hex wrench compresses the hydraulic fluid, and lifts the pad to raise your dent.

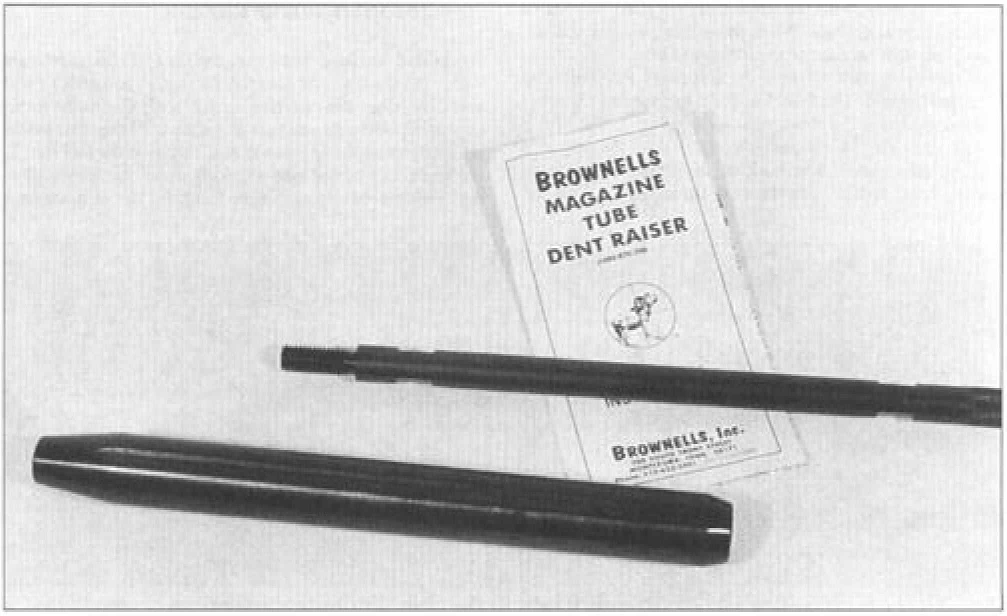
The expansion bolt attempts to compress the hydraulic fluid within the rod. The fluid has been formulated to resist compression. Since the fluid will not compress, the lifting pad must rise. The lifting pad is smaller than the opposite side of the lifter head. The back of the lifter head is supported on more surface area than the lifter pad is. With the compound leverage you have, the dent of the barrel cannot withstand the force of the tool. In fact, if you aren't careful, you can bulge the barrel with the tool. Carefully turn the

expansion bolt a partial turn at a time until the dent has been raised. Loosen the expansion bolt and slide the tool out. Take the barrel out of the vise and look down the length of it. If the dent is not fully raised, or has been raised more on one side than another, you will be able to see it. You may have to use the lifter two or three times to evenly raise the dent. To remove the last traces of the dent, loosen the locking collar. Pull the lifter away from the dent and gently tighten the expansion nut. When the lifting pad touches the bore, but doesn't press on it, you have adjusted it to become a bore gauge. Slide the tool back and forth through the location where the dent was. If any part of the barrel wall is still dented, the tool won't pass under it. If you find a tight spot, move the locking collar to half an inch from the end of the barrel and lock it in place. Loosen the expansion nut and slide the tool in until the collar stops it. Tighten the expansion nut. You wilt not need to tighten it more than a fraction of a turn past contact with the dent. Once the dent has been evenly and completely lifted, use your bore polisher to smooth the surface where the dent was, and the lifter pressed.

Occasionally I would see a shotgun brought in with a dented magazine tube. With a big enough dent, the tube could not feed. The shells or follower would become hung up on the dent, and not work. The magazine tube wall thickness is not as great as that of the barrel, and a tapered plug can lift the dent. While the dented thinner walls of the magazine tube would be even easier to lift with the hydraulic lifter the tube is also larger in diameter. After all, the magazine tube has to hold the rim of the shell with clearance room. The lifter does not have enough travel to raise a dent in a magazine tube. However, the scrap barrels came to the rescue. I took a section of cut-off barrel and slit it down the middle. With a file I knocked the edges off and rounded the corners. With tape holding the barrel section onto the back of the lifter head, the lifter pad could lift dents out of magazine tubes.

The lifter will not raise cuts or gouges that are in the exterior surface of the barrel. To remove these marks, you must file and polish the exterior and then blue it.

At $224 per gauge, you may not need a hydraulic lifter for one dent. But if you will be working on several shotguns, it is the neatest tool to come down the pike since the first caveman figured out dinner was easier to cook if you put it on a stick.



A simpler and cheaper way to lift magazine dents is with a mandrel. Drive it in, pull it out, and your dent is lifted.

Back-Boring

One-piece plastic wads make many things possible that were not possible with old fell and cardboard wads. The bore of shotguns using the old wad column or wad stack had to be the same size as or smaller than the wad diameter. If the bore was larger, the wads would not seal against the bore. Gas would leak by, pellets would go astray, and performance would suffer.

A plastic wad will expand to fill the bore, almost without regard for the diameter. Not that a 12-gauge wad would fill a 10-gauge bore, but it would expand a great deal. Why would you want to put a wad through all that? Pattern uniformity, lower pressure and reduced recoil. For those improvements, many shooters are willing to torture their wads.

Back boring is either done at the factory, or afterwards by custom gunsmiths. The Mossberg 835 is factory back-bored. The inner diameter of the barrel is nearly ten gauge in size. By back-boring the barrel, Mossberg can make the shooters job of launching those 3-½-inch Magnum 12-gauge payloads easier on the shoulder. Can you back-bore your barrel? If you have a large lathe and the specialized reamers, yes. Are you willing to invest

$10,000 for equipment, and scrap a bunch of barrels practicing? This is something only you can answer.

How do the custom 'smiths do it, and what are the benefits? First the bore is scrubbed, and once the barrel is clean, the inner diameter is measured from forcing cone to choke. The wall thickness is then measured to make sure the bore is sufficiently concentric. It wouldn't do to back-bore a barrel that is too far out of concentricity, and leave a thin spot in the walls. A careful and prudent gunsmith wiil send back unsuitable barrels with a note why. The barrel is chucked in a large lathe, and the boring reamer is assembled. The reamer has an exchangeable bronze pilot on the front of it. A pilot matching the current inner diameter of the bore is installed, and the reamer is run into the barrel while the barrel turns. Once reamed, the bore is measured, polished, measured again and shipped out.

The larger-bored shotgun will have less recoil, a lower pressure for any given load fired in it, and more uniform patterns. Is the advantage worth it? If you are a duck or goose hunter, is it worth it to bag one more duck or goose that you might not have gotten? Or if you are a competition shooter, is it worth the lower fatigue at the end of a long string of straight hits? If you get that last hit to break 100 and get into the shootoffs, I'll bet it was worth it. For most people, in most situations, the advantages are theoretical at best.

A Bent Barrel

Along with dents and nicks, barrels get bent. The major cause of bent barrels is not that the shotgun has been dropped, but that it has been sat or stepped on. The dropped shotguns end up with dented barrels. To bend a shotgun barrel you have to be very unlucky or inattentive. One combination that causes bent barrels is soft shotgun cases and car trunks. The soft case does not offer any protection when the rest of the cargo shifts. When your cooler topples over onto your shotgun, the barrel can end up getting bent. The easiest way to keep your barrels straight is to use a hard case to transport them.

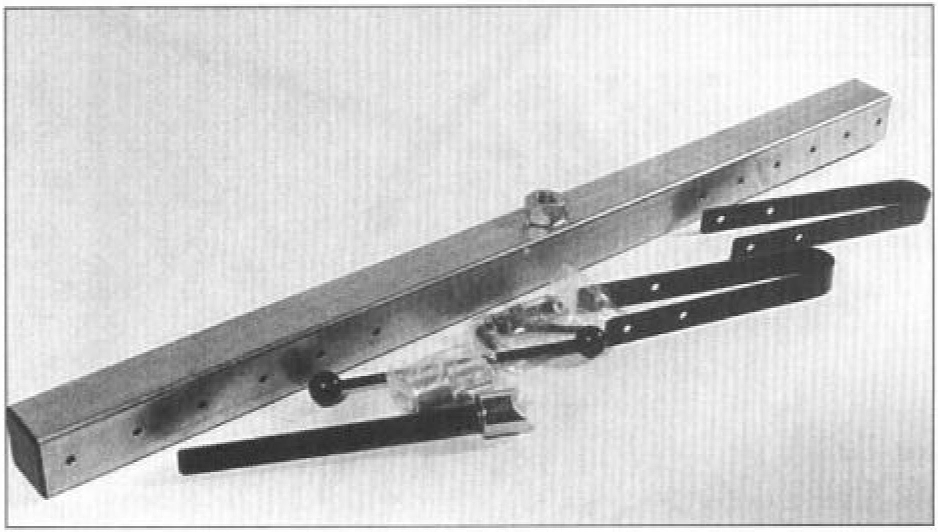
There was one case of a bent barrel that even had us at the gun shop slack-jawed and shaking our heads. The owner had loaned his shotgun to his brother-in-law (The Simon loaner principle: “Guns are only loaned to a brother-in-law, and no other relative.”) who brought it back bent. His brother-in-law had become so enraged by his constant missing that “he put

the barrel in the crook of a tree and yanked on it.” The barrel was bent in a visibly odd angle, and bent so much it posed a weird aiming problem: do you aim along the original straight section, or try to put the bead on the top center of the receiver? Either way, you will miss your target, by an amount somewhere between several compass points and a zip code.

It bears repeating: Do not loan your guns unless you are standing right there while the loanee shoots them, or you have a great deal of trust and belief in the loanees abilities and common sense.

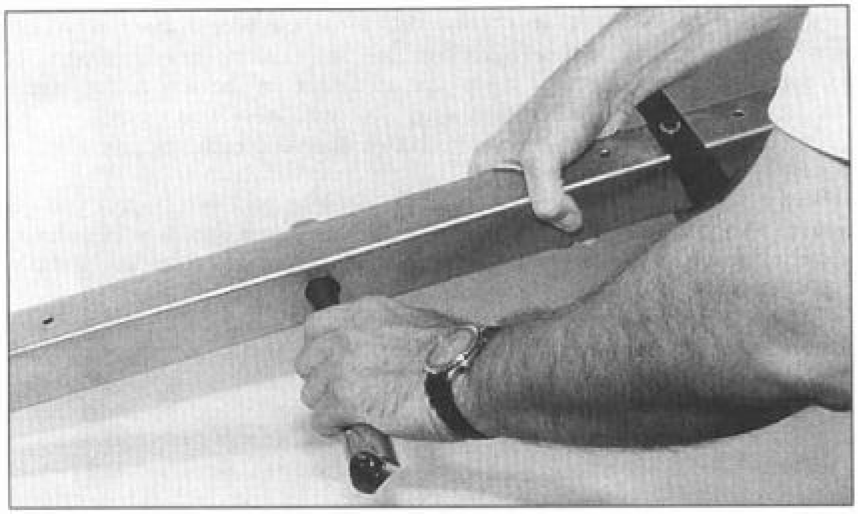
The problem with a bent barrel is that the bead is in the wrong location in space. When you shoot, the shot goes somewhere other than where you aim. A barrel bent downwards could hide the bead. Bent barrels can be straightened, but there are limits. If your barrel is bent too much you will have to replace it for safety reasons. Bending steel causes stress called work-hardening. The original bending created some stress, and you will further work-harden and weaken the barrel by bending it back. If your barrel is bent more than 2 inches off center it may have been bent too much. A bend of 3 inches is too far, replace the barrel. Now, 3 inches may not seem like much, but if you have ever seen a barrel bent that much you would take one look at it and think it was meant for shooting around corners. How can you tell if your barrel has been bent? In extreme cases all you have to do is look. By sighting down the side if the barrel, even the slightest bend becomes apparent. To determine subtle bends you will have to have patterned your shotgun beforehand. If your shotgun was hitting perfectly to the bead before, and now the pattern center is shifted a foot or 2 off, the barrel is bent. Assuming you have not changed your stance or how you view the bead.

To straighten a barrel you need a barrel straightening fixture. Brownells offers one made by B-Square, and, as with the hydraulic dent raiser, it may be too expensive for one job.

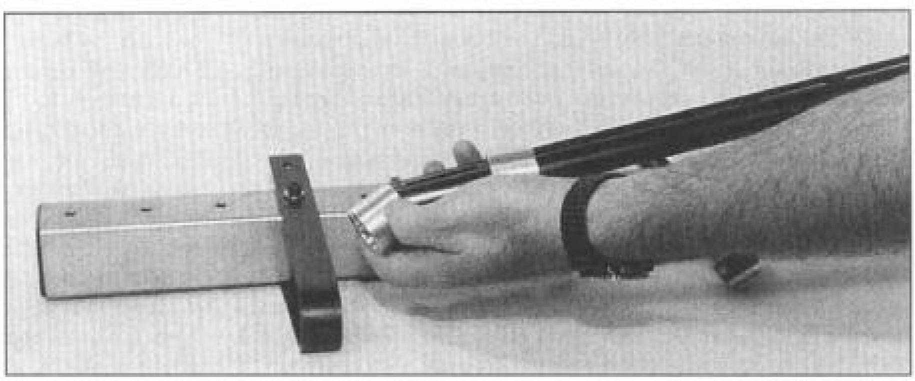


***The B-Square barrel press lets you straighten bent barrels*.**

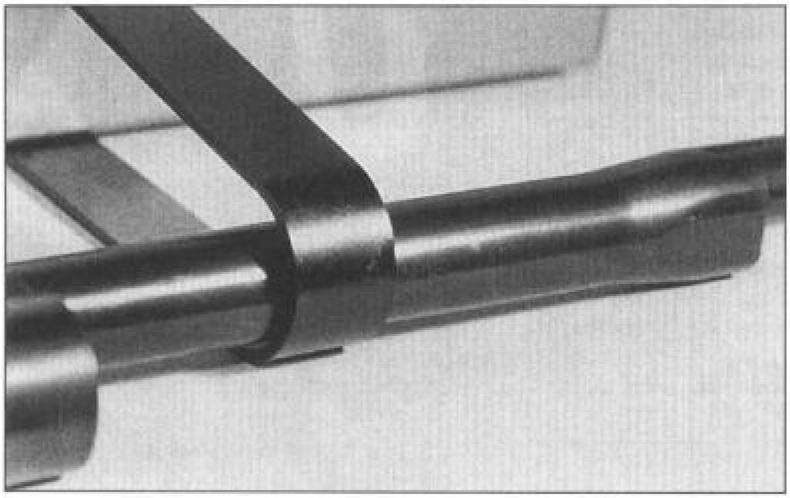
The barrel straightener can only be used on single-barreled shotguns. You can't use it on doubles. If you have a double barrel shotgun that has been struck hard enough to bend the barrels, you are faced with a repair beyond the abilities of the home gunsmith. To repair the double properly, the ribs connecting the barrels have to be removed. Then each lube has to be straightened, along with the bent ribs. Then the barrels have to re-regulated, and the ribs soldered back on again. The cost would be staggering, and unless we are talking about a London best (what a shame that would be) the cost of the repairs would exceed the value of the shotgun.



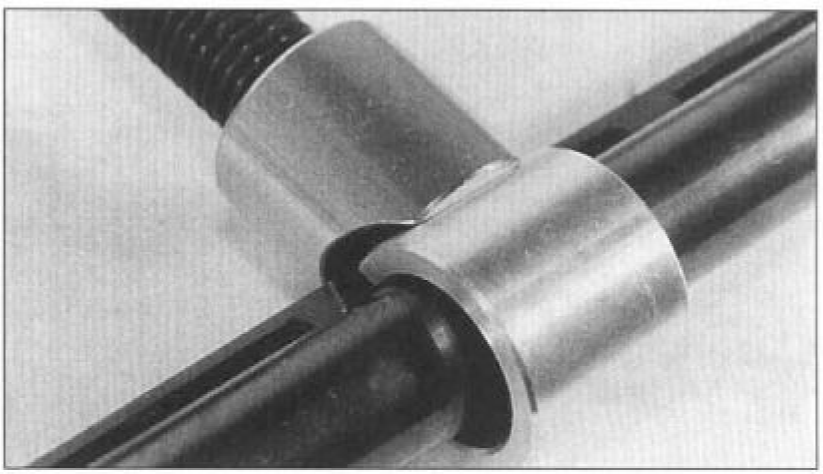
To assemble the barrel press, install the screw press in the bar.…



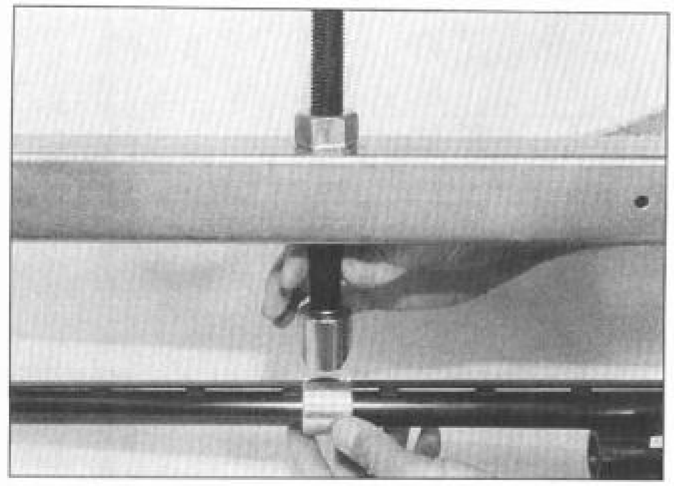
… hang the barrel supports and slide the bushings on the barrel.



The strap that goes under the barrel where it is hidden by the forearm does not need a bushing.

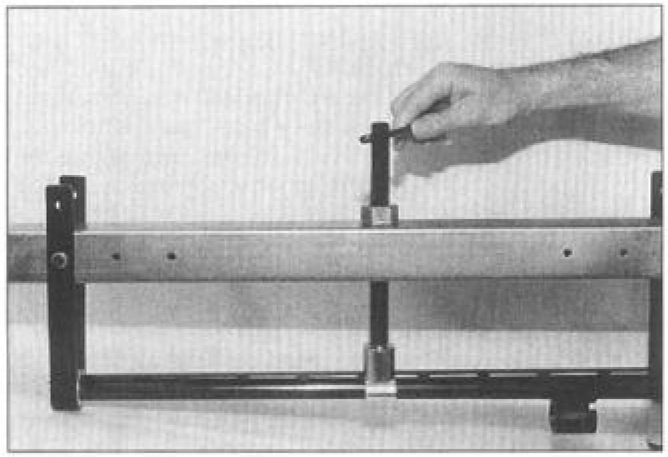


Place one of the bushings over the bend, and tighten the screw press until it traps the bushing in place.



***Turn the barrel so the bend is up and the bend is directly under the screw press*.**

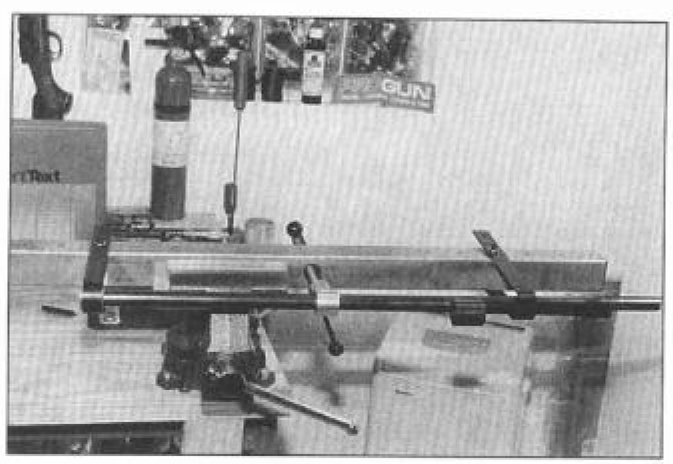
Remove the barrel and use a piece of tape to mark the bend. Most bends will be just in front of the barrel hanger or gas system hood. The barrel was supported by the magazine tube up to that point, and then was on its own forward to the muzzle. When struck or sat on, the barrel will bend at the point where the force times leverage exceeds the strength of the steel. Clamp the barrel straightener around the barrel with the center post right on the bend. Turn the handle of the center post, and use the leverage of the moving screw to flex the barrel back to being straight. Remove the fixture and inspect the barrel. You do not want to try to remove all of the bend on the first try, because you might bend the barrel the other way. Put the barrel back into the fixture and flex it again, in the same direction but a smaller amount. When the barrel looks straight, test-fire and pattern it to see.



The screw press bends the barrel.

Point Of Impact

The sharpshooters among you will have immediately grasped that very slight bending of a barrel can be the way to get it hitting to the bead. When straightening the barrel or adjusting the point of impact, you will need to take the barrel straightener to the range along with the load you will use and your patterning board.



You can clamp the press in a vise to hold it while you turn the screw press.

…to straighten the barrel.

Why would you want to bend an otherwise straight barrel? The one application that comes to mind is trap shooting. In trap, the bird is rising as it is traveling away. Many Trap shooters prefer a shotgun that puts more of its pattern above the bead than below, to get pellets up where the bird is headed. Other clay bird games are not so specialized. In skeet shooting, the birds are going to the sides and are not always rising. In sporting clays some of the birds may be going downwards as if they had just fallen off a building. While you are hunting you never know which way the real birds will be going, so you want your pattern centered on the bead.

To adjust your barrel, take the shotgun, ammunition and the barrel straightener to the range along with your patterning board. Shoot test patterns before you start bending. Once you have determined which way you want the pattern to go, unload the shotgun and remove the barrel.

Install the fixture on the barrel and place the center post of the fixture in front of the barrel hanger. Bend the barrel slightly, with the center post pushing the middle of the barrel opposite of the direction you want the pellets to go. If you want your pattern to move up, you push the middle of the barrel down. If you want the pattern to move right, you push the middle of the barrel to the left. Make small adjustments. Remove the barrel from the fixture and test-fire it. Check the center location of the new pattern to the center location of the old pattern. When you have the pattern moved to

where you want it (usually centered on the bead) stop and resist the temptation to adjust it “just a little more.”

Look along the barrel to see if you have it straight. As another method, take the barrel and press to the range and pattern-test it.

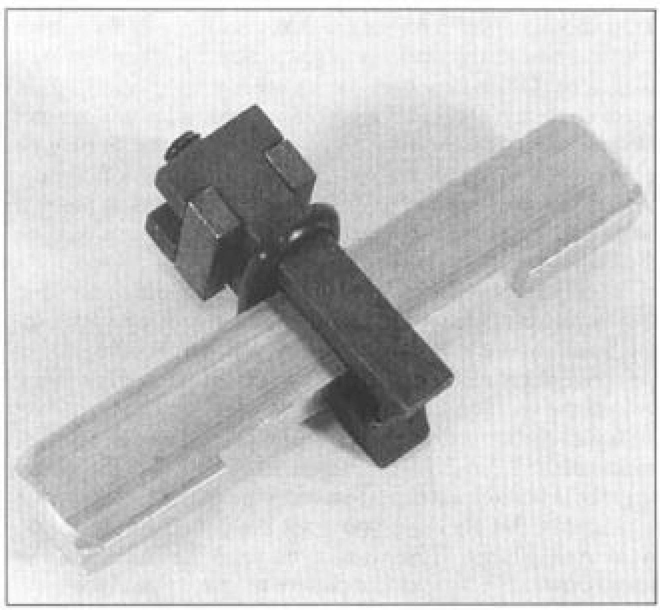
Bent and Dented Ribs

Sometimes when a shotgun slides to the ground and clatters to a stop, the barrel is not bent but the rib is. Many old shotguns had a rib known as a solid rib. The rib was a solid bar along the top of the barrel. Some were even made with the rib as an integral part of the barrel, and not a piece soldered on after the barrel was turned. Far too expensive to make even between the wars, such barrels are minor collectors' pieces now. Modern ribs are soldered or brazed to the barrel, and are of the type known as “ventilated ribs.” The body of the rib rides on posts set a couple of inches apart. On most ribs, like the Remington style, the posts are an integral part of the rib. On Mossberg shotguns, the ribs are soldered to the barrel and their tops are milled with a pair of grooves. The rib is a bar with a slot underneath that rides in the grooves of the posts. The rib is attached to the barrel by a pin through the rib and rear post. Riding in the grooves, the rib is

free to expand and contract differentially than the barrel, avoiding the slight bend barrels take as they heat up.

The open span of the ventilated rib can become dented when struck, and must be straightened. If it isn't, when you aim the dent looks like a dark line extending across the rib. This spoils the clean line of your view of the bead and target. If manufacturers made solid ribs, the denting problem would not exist. They make ventilated ribs because that is the fashion, what shooters want. It would be just as easy to make solid-rib barrels, but everyone wants the ventilated ones.

You'll need Murray's Vent Rib Tool from Brownells. In operation it is simple. Place the tool on the rib at the dent. Adjust the arms so they rest under the rib right at the dent. Tighten the clamping nut until the rib has been pulled up straight. Loosen and remove the tool.



***The dented rib press is a simple little gadget*.**

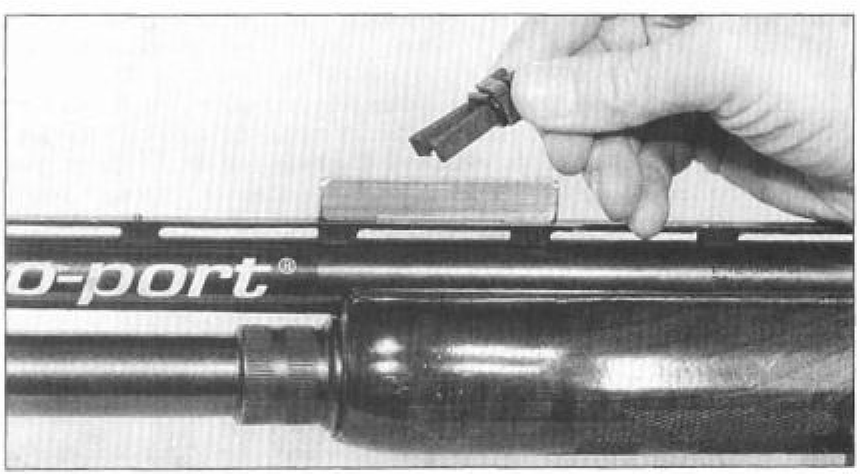
Barrel Length

Black powder, with its relatively low burning pressure and low efficiency, demanded long barrels. Rifles and shotguns had barrels in excess of 30 inches, sometimes longer than 36 inches. Smokeless burns more efficiently, and more importantly, the charge is consumed within the first couple of

inches of the payload's movement. The chamber pressure reaches its peak within those first couple of inches, and then the pressure quickly drops off. If you shorten a barrel you will be removing the action of the gases on the payload at the end of the curve where the pressure is the smallest.

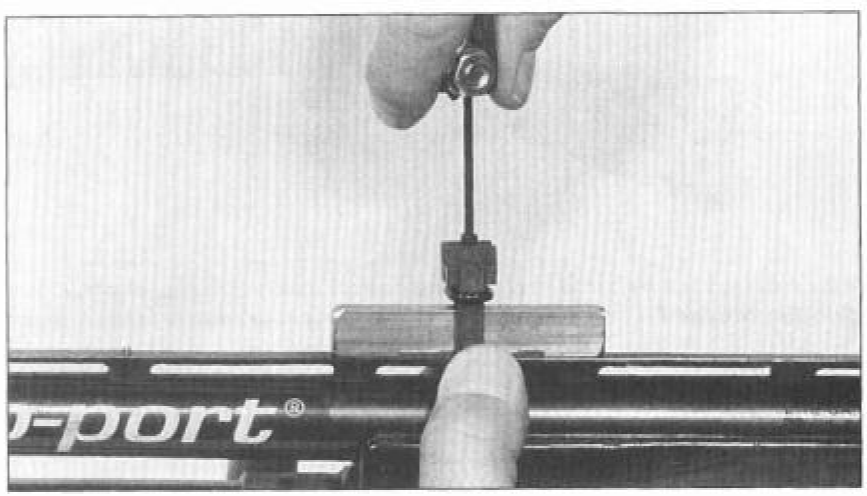
Indeed, you could make a barrel so long (or a load so weak and low-pressured) that the gas pressure is not enough to offset the frictional forces on the wad, and the velocity would actually be lower. Shorten the barrel and you could make the load faster. Not much, but a few feet per second.

Place the anvil over the dent.…

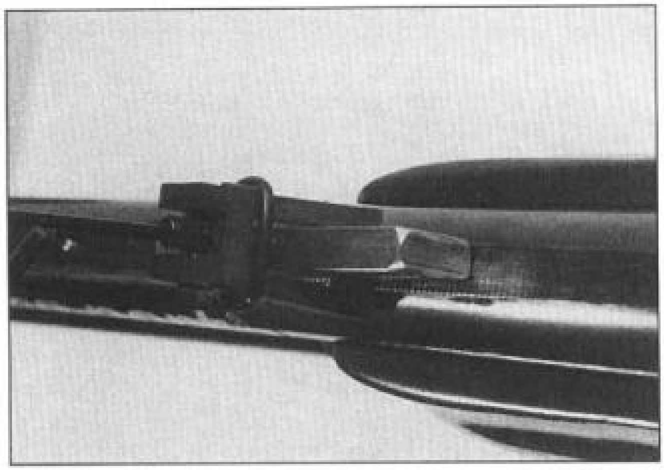


…spread the jaws of the clamp.…

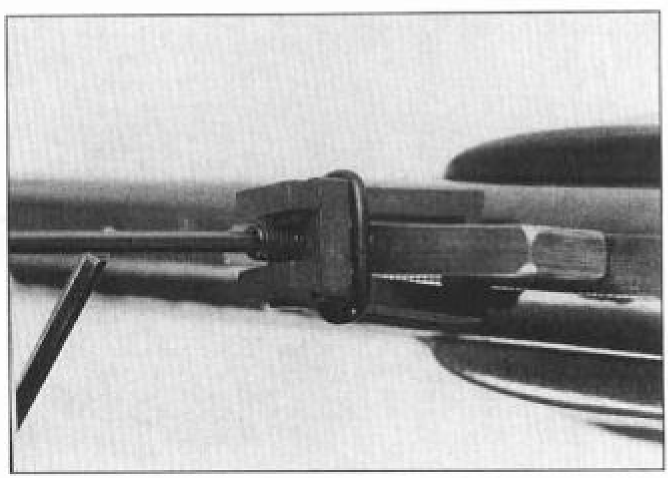
… and place it directly over the dent.



Tighten the top screw to lift the dent.



Make sure you get the jaws square to the rib.



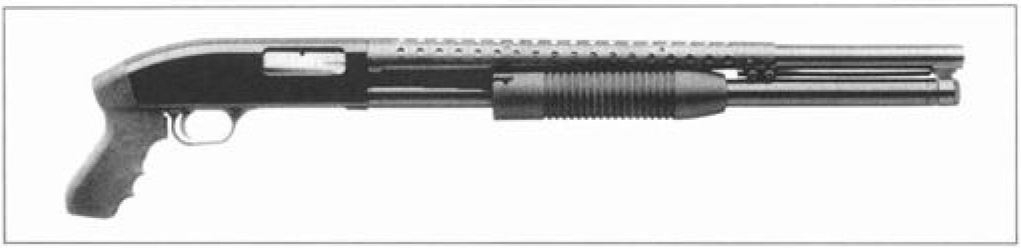
If the jaws are angled, they might slip off when you tighten them, marring the rib.

The difference between the velocity you would get from a 20-inch barrel and from a 30-inch barrel isn't much. As a matter of fact, the differences between individual shells of a load, and the velocity potential of each barrel, is as large as the length factor. You can have a 26-inch skeet barrel that is just as fast as a 30-inch duck barrel.

As far as the choke is concerned, length doesn't matter. A full choke tube screwed into a 20-inch barrel is going to do the same job it would do in a

30-inch barrel.

Select your barrel length for balance and the terrain. A longer barrel provides a more precise aim, so duck and goose hunters use long barrels for high-flying birds. Grouse hunters have to struggle through the brush, and thus select shorter barrels.



Even a short barrel will deliver a controlled pattern if it is choked. The lack of a stock does make it tough to aim, but with practice hitting is not difficult. (photo courtesy O.F. Mossberg & Sons)

With a stock, even a short barrel can be accurate and, with some choke, deliver a pattern. The U.S. Border Patrol uses shotguns like this, and is very happy with the results. (photo courtesy O.F. Mossberg & Sons)

CHAPTER 8
Insert Tubes and Smaller Gauges

In multi-gauge skeet, trap or sporting clays, you'll need these four shells…

The perceived need or desire for a smaller gauge comes over every shooter sooner or later. Some try them because they are tired of getting pushed around by a 12-gauge. Others “go small” because they want a challenge. Some because the truly serious competitors will shoot with anything and everything. The smaller gauges, 20, 28 and .410, do indeed kick less than a 12-gauge would. After all, they throw less shot. Less payload means less recoil.

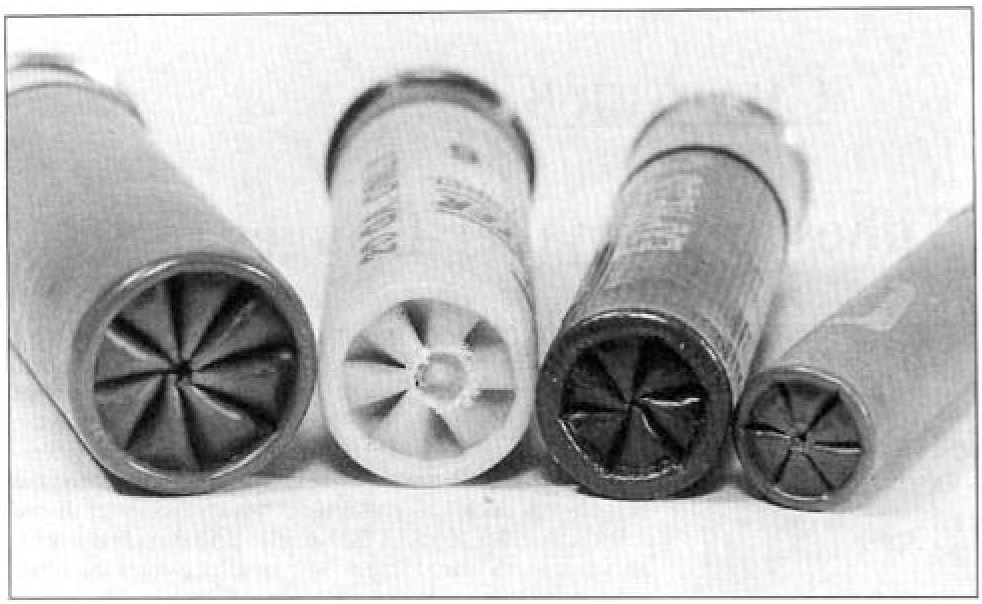
… 12, 20, 28 and .410. Four guns, with four different stock fits, or one gun and insert tubes? Easy question.

For competition shooting, the 16 gauge is not a “smaller” gauge. The 16 was passed over when four-gauge skeet rules were established. The recognized gauges were set as 12, 20, 28 and .410. The useful 16 was left out in the cold and has struggled for much of the 20th century. Perhaps things will improve for it in the 21st. Except for the really heavy duck and goose loads which are not available in 16-gauge, the 16 kicks the same as a 12 does and is usually built on the same frame. The smaller gauges are often built on their own, downsized frames. One notable exception to the custom of building 16-gauge guns on 12-gauge frames is the Browning “Sweet Sixteen.’ Brought out when the 16 was still popular, it is an A-5 built on its own scaled-down and lightened frame.

But back to the smaller payload, because that is where the challenge comes in. Less shot means a smaller pattern or less range, or both. A sloppy hit with a 12 can be a missed bird with a smaller gauge. The tradeoff leads to a situation that is one of my pet peeves: starting a new shooter with a .410. The idea is that the almost non-existent recoil will be less startling than a big gun, and less likely to lead to a flinch. The problem I have seen with starting in a .410 is the lack of hits. Everyone, kids or adults, likes to see results. No reduction of recoil is worth constant missing. If you want to start a new shooter, use the lightest-recoiling load in a 20-gauge you can

get. A new shooter won't notice recoil once they start breaking birds. Stop them at the first sign of a flinch or fatigue. End of lecture.

Serious competitors use the smaller gauges to add to their sport. Many skeet clubs or leagues have smaller gauge competitions or dual-gauge shoots. Sporting clays courses often have shorter distance stands for the smaller gauges, and a dedicated shooter will shoot both. After all, the shooter may have traveled quite a distance to shoot, why not do more shooting?

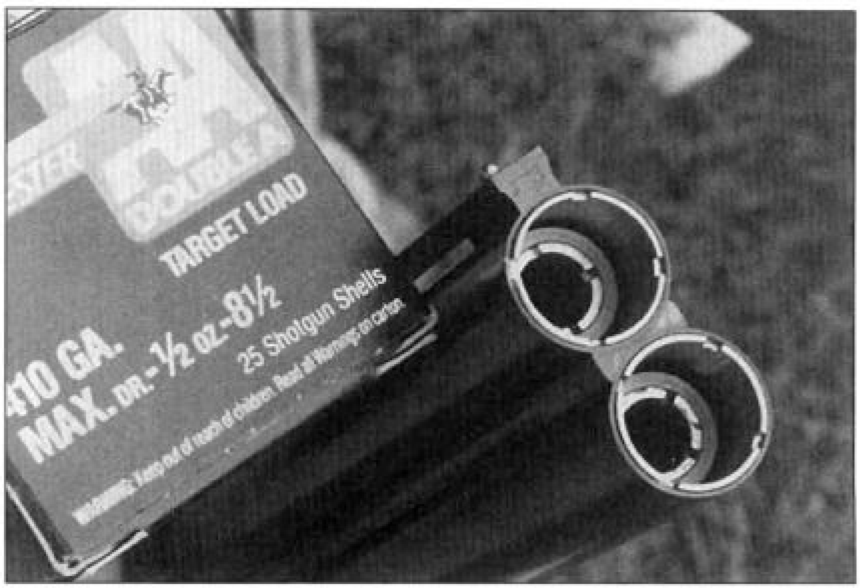


***From the diameters you can see the space the tubes must fill to make inserts work*.**

There is a fly in the ointment, however. A second or third gun in the smaller gauges can be expensive. Expense should not be discounted as a discouraging part of competition or hunting. Lets take two shooters as examples. One uses a pump or auto, and wants to shoot smaller gauges at the club, or in hunting. Buying a new or used additional shotgun can easily run an average of $400 to $500 each. The smallest gauges would run more, due to lower supply. And then there is the fit. Will the second (third and forth) gun have identical stock dimensions? Will the balance be the same? If the two guns are too different, you will spend the first few stands or shooting positions re-learning the swing for the gun you have just picked up. For those of you shooting pumps or autos, the only thing you can do is

modify one of your two guns to the dimensions of the other. Use the one that you hit the best with as the pattern. Usually you will have to slightly alter the stock for pull, comb height and cheekpiece location. On the smaller-gauge gun, you also have to add weight to bring its mass up to that of the 12-gauge and to balance the lighter gun. On pumps and autos, adding weight is easy. You add weight up front by installing a weighted magazine tube cap. You can add weight in the rear by drilling out the buttstock and adding pieces of steel bar or pouring in lead shot.

With the proper-sized choke tubes in place, your insert tubes won't rattle.

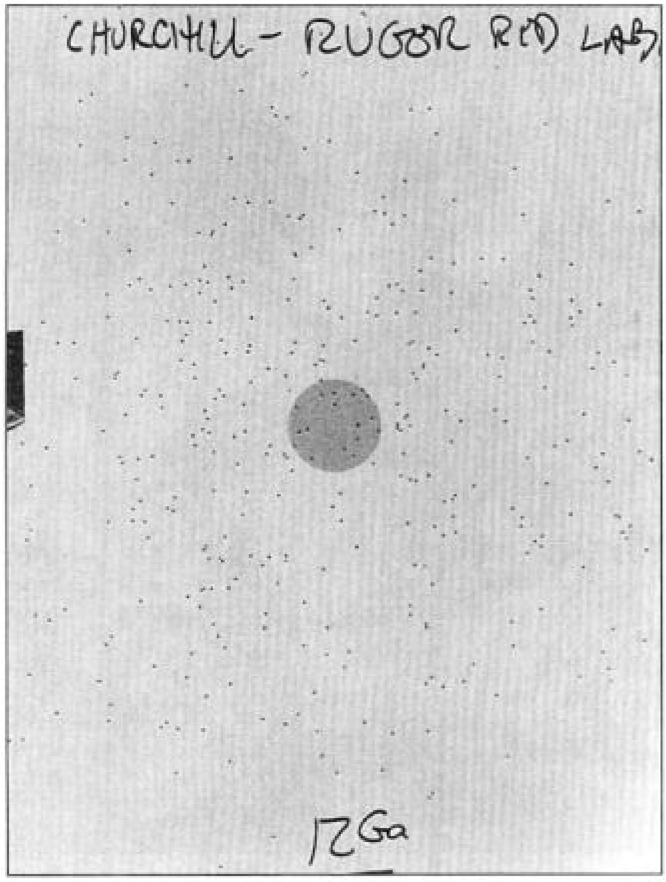


A four-gauge set of guns can run more than $2,000, plus the time and effort to make them all match in weight and balance. If you're looking for something to do to keep you occupied now that you've collected the payout on your Internet IPO, fine. For the rest of us, it is a different question. Having spent all this time, effort and money, how much of them are left over for practice ammo?

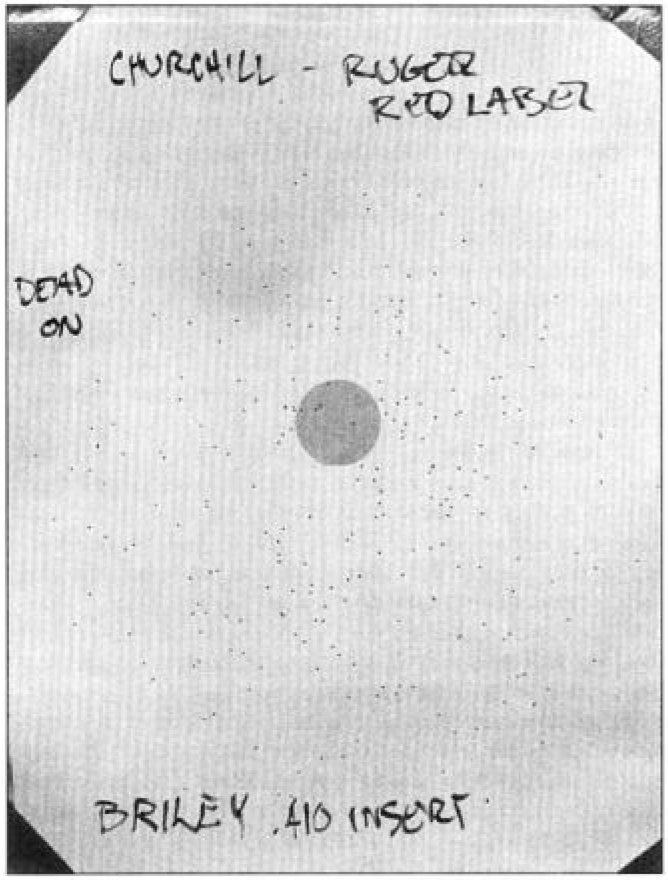
Our second example shooter will not shoot with anything but a double. Here the cost can get staggering. Buying four doubles just to have a matched set in four gauges is an expensive way to go about it. The four will cost at least twice as much as the four pumps or autos would. And, he would have the same problem of making sure they all fit and balanced the

same. Jaqua's of Findlay Ohio had a matched set that would turn anyone green with envy. It consisted of a pair of matched doubles in each gauge, complete in their custom-made cabinet. The set cost more than a cozy little bungalow would. Failing to feel the need (or have the cash) for such a set, our example shooter could have custom-built a double with extra barrel sets. A double with three smaller-gauge fitted barrels might be obtainable for less than a year's wait and $4,000, but it would be a very plain shotgun. At least it would solve the problem of differing stock dimensions and balance. In the days of fixed-choke barrels, some doubles were made with an extra set of barrels fitted to the gun. The extra set would usually have the barrels choked differently than the first set. After all, if the owner wanted the same chokes he'd have the second barrels made on their own receiver, for a matched pair of guns. Since a large part of the work of creating a double-barrel shotgun is invested in fabricating, fitting and regulating the barrels, a two-barrel set would cost almost as much as two guns. As a result, multi-barrel sets are rare and costly, and do not appear on the used market for much less than their new cost.

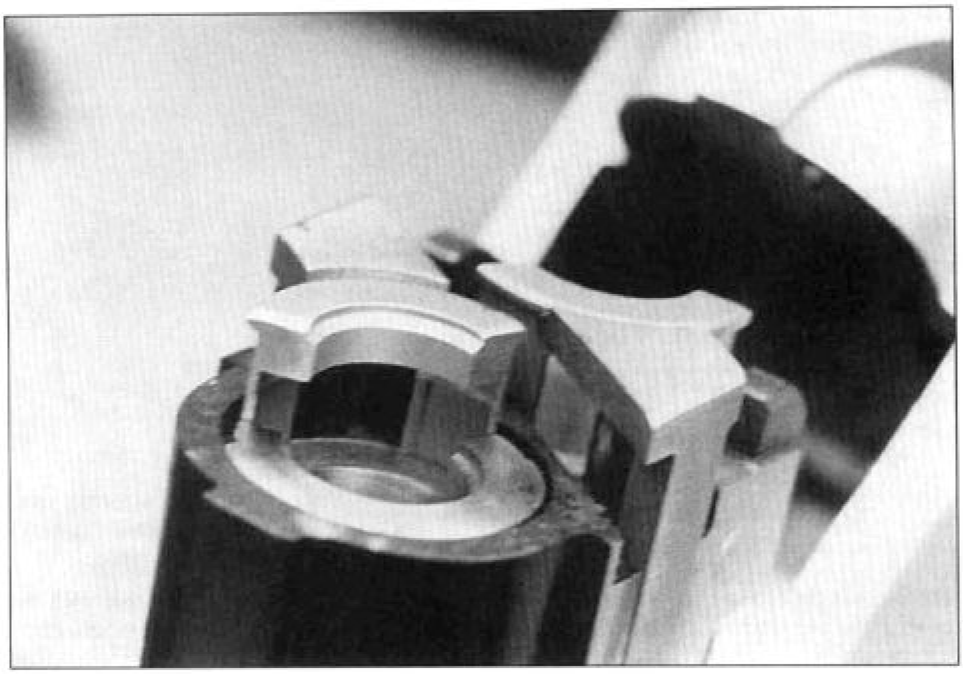
Rather than buying more guns, you can add gauges by using insert tubes.



Using the Churchill method, the Ruger Red Label fits me. (Maybe I should hang onto it?)



The Briley insert tube hits to the same spot as the 12-gauge bore. (Should I keep the tubes, too?)



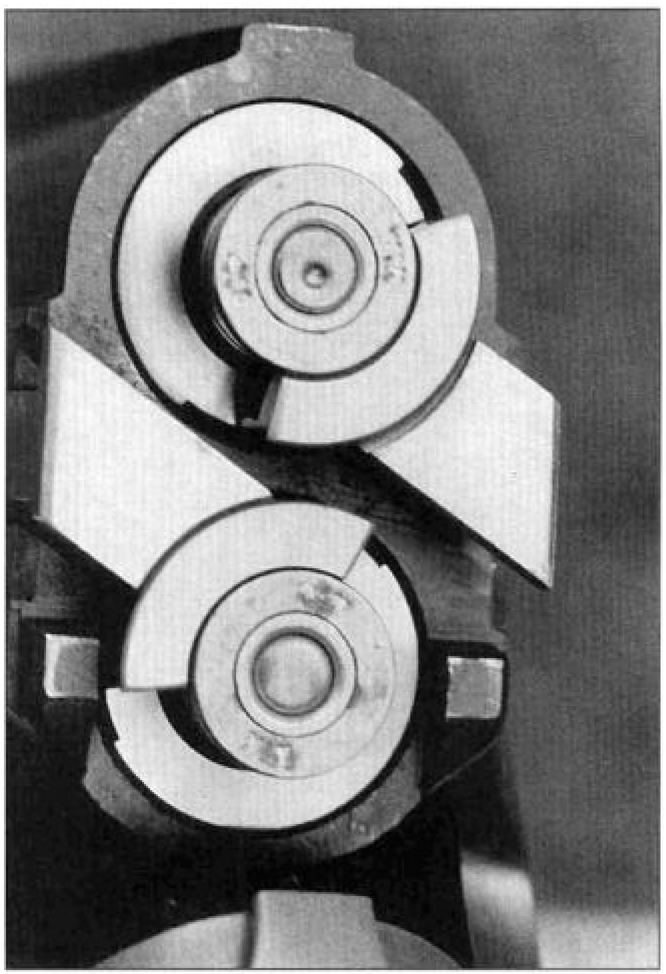
The insert tube extractors lift with the barrels extractors when properly lined up.

The matched two-gun sets are almost all British side-by-side shotguns. The landed gentry of England would hunt driven game, standing behind a low wall. Standing behind them would be an assistant with the spare gun. As soon as the shooter emptied the barrels of one, he'd hand it back, take the loaded spare, and be ready in an instant. The assistant would reload. A smooth gunner and a trained assistant could have four dead birds in the air at once. A hunting party in the old days would bag hundreds of birds, birds raised expressly for the purpose of being shot by the upper class.

Those of you who are using doubles have another option. Instead of buying another shotgun, you can buy insert tubes. Insert tubes are just that, tubes you insert into your present barrels. The tubes are bored and turned out of aluminum bar stock. The chambers are either titanium or stainless steel. The muzzles of the lubes are threaded for screw-in choke tubes. The aluminum is hard-coat anodized and color-coded. For those who might think that aluminum isn't hard enough, remember, we're sending a payload of lead shot wrapped in plastic through the tubes. Skeet, trap and sporting clays shooters use insert tubes, and you'd be hard pressed to find higher-volume shooters than these.

Depending on the cost of your initial shotgun and the cost of the tubes, you can buy a tube set that gives you all three smaller gauges for the cost of another shotgun in only one smaller gauge. Instead of $4,000 or more, you can be shooting for only $2,000. Tubes are much less costly because they slide into your barrels and do not need the fitting and regulating that a spare barrel set does. The insert lubes also ensure that you will be shooting a shotgun in all four gauges that has the exact same fit and triggers.

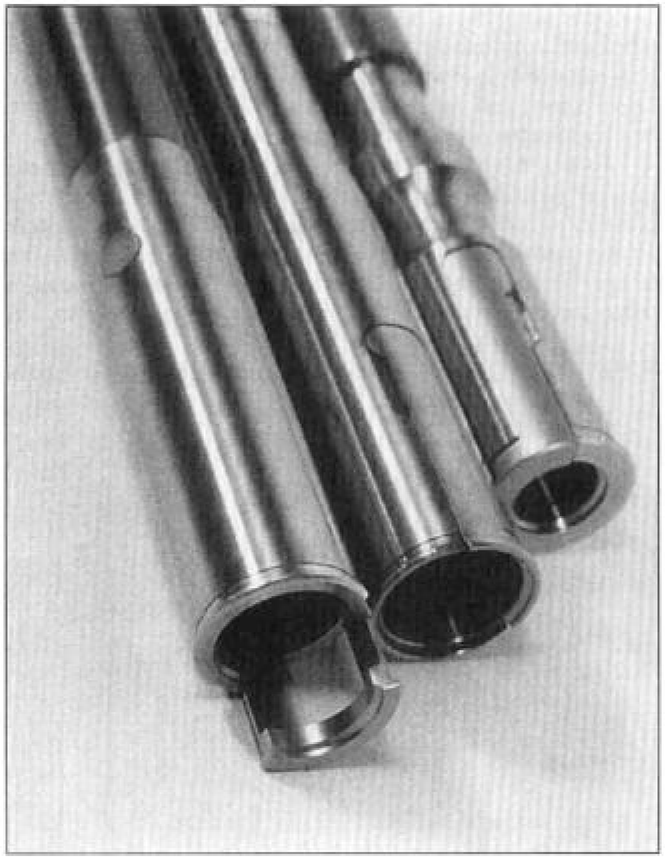
Insert tubes are made of hardened aluminum with extractors filled at the chamber end. The extractors of the tube engage the extractors on your gun, and the insert tubes extract or extract and eject just as your shotgun would. Tubes come in two types. The fitted tubes are turned and fitted to a particular barrel. Not only is it unlikely for fitted tubes to work in another shotgun, they can be so precisely ground that on some guns you can't switch the upper and lower tubes.



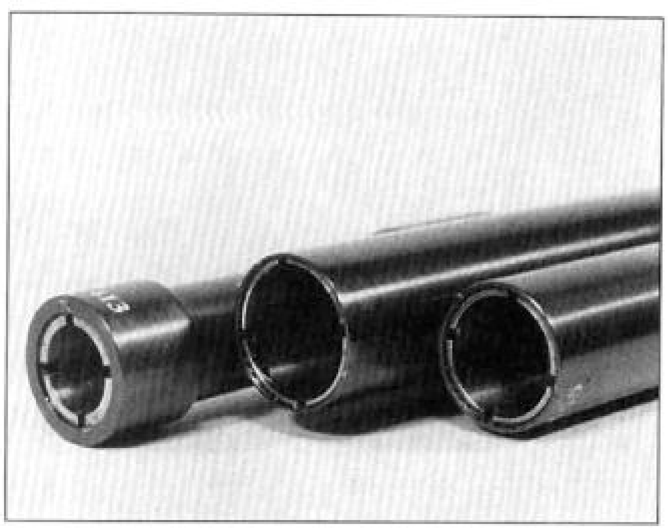
If your shotgun is equipped with an inertial single trigger, and the second barrel won't fire, send it off to Brileys for adjustment.

Briley makes another type of insert tube, the drop-in. I won't call these “one-size-fits-all” because Briley wants to know what brand shotgun and what length barrels it has before they can ship your tubes. You also have to tell them if your gun has been back-bored or not. You do have the choice of “Ultralite” and Standard Weight tubes. The UL tubes weigh 10 ounces, while the Standard ones weigh 14 ounces. Whether you get the UL or the standard insert tubes, the weight of the tubes matches in all three gauges. On the “Ultimate Ultralite” tube set, not only do the weights match, but the tubes all have the same balance point. Complete with four screw-in choke tubes per gauge (yes, the insert tubes are threaded for screw-in chokes!) you can get a tube set for about the same you would pay for a well-made and moderately decorated double.

How do you use an insert tube? Easily. My preference is to thoroughly scrub the bores clean before installing the tubes. While you can probably get away with installing tubes in a dirty bore, I'd rather not find out the hard way that the built-up plastic in the bore has a tube firmly wedged in place. Once clean, take the gauge set you will be using and wipe one with a clean cloth. Check the fit of the tube in your chokes. Briley recommends the use of a Full tube for the 28-gauge and .410 insert tubes, and a Cylinder choke for the 20-gauge tube. If you use a larger choke, your insert tube may rattle or vibrate, but it will not harm the tube or barrel, or cause a performance problem. Take a choke tube of the diameter you have in the barrel (or remove the present choke tube) and slide it over the muzzle of the insert tube. Once you are sure your tube will properly fit the choke, tube the choke and screw it back in.



The rear of the tubes have their own chambers and adapters to use the factory ejectors.



The muzzles of the insert tubes are proportioned to fit the choke of the bore, and have their own screw-in chokes.

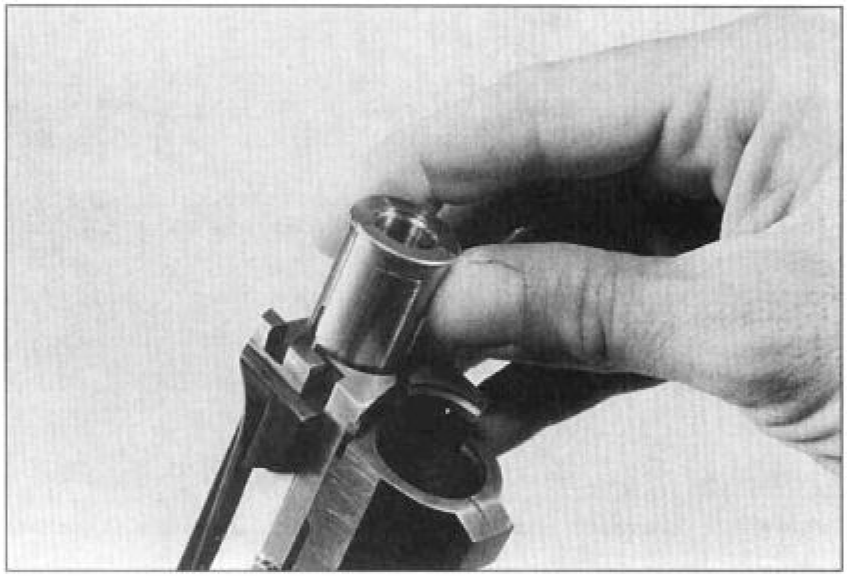
Now slide the insert tube into the bore and hold it a couple of inches away from seating. Turn the tube until the built-in extractor of the tube lines up with the extractor in the bore. Now slide the tube into the chamber. Press with your thumb. You will not be able to fully seat the tube. Take the Power Knocker that Briley included with each tube set and place the copper end against the rear edge of the tube, on the solid portion. Do not place the Power Knocker on the extractor, as you may bend the extractor. The Power Knocker is a specially-designed slide hammer intended to fully seat the insert tube. Slide the weight and whack the copper end against the tube, seating it. Repeat if necessary. To check the fit, attempt to close your shotgun. It should close without any more force than it usually needs.

Repeat with the other tube.

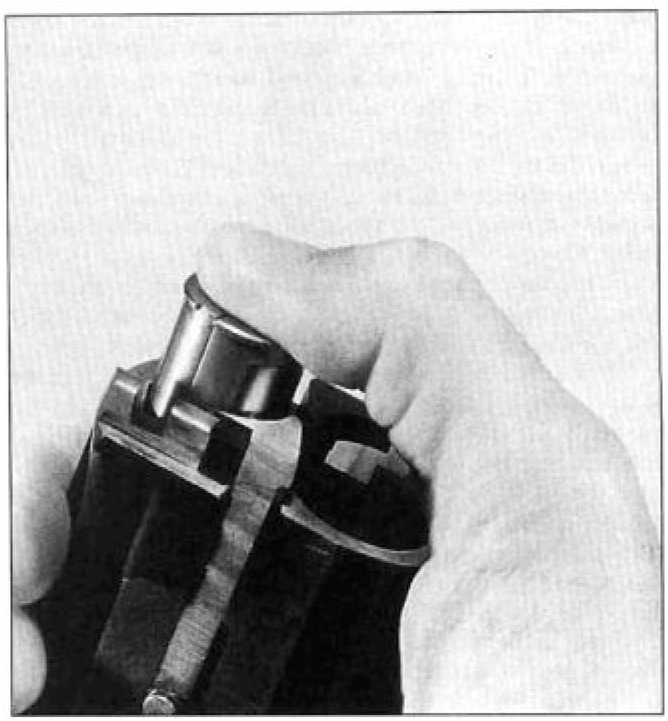
measure your insert tubes and match them up with the correct choke.

Slide the tubes into the bore…

When it comes time to remove the tubes, make sure the shotgun is unloaded. Remove the barrels. Grab the barrel set by the muzzle and hold the breech end a couple of inches over a padded surface. Take the Power Knocker and insert the plastic end into the muzzle of the insert tube. Whack the slide against the tube and pop the tube loose. Switch the Power Knocker to the other tube and pop it loose. Grab the insert tubes with your other hand, and turn the barrel set horizontal. You can now slide the tubes out.



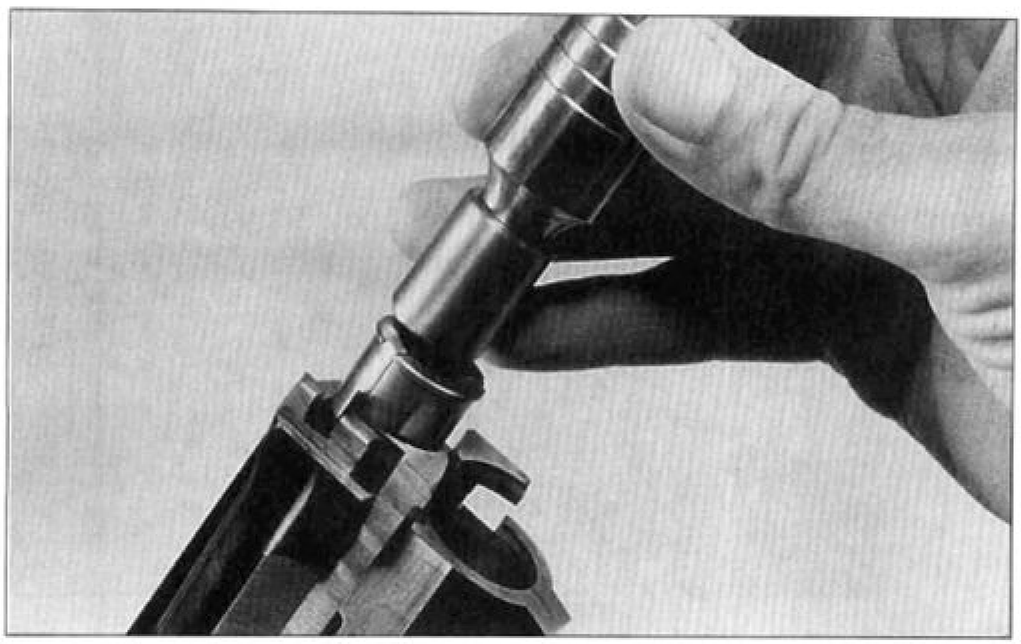
Line the extractor adapter up with the barrel extractor…



…and press into place with your thumb.

Clean your tubes before you put them away. Since the tubes are aluminum, it should be obvious that you never use a stainless brush to scrub the tubes clean. I don't even use a brass brush, and scrub my tubes only with a plastic bore brush and wipe it out with cleaning patches.

Modern double shotguns have a single trigger, and to reset the mechanism from one barrel to the next involves a pivoting gizmo known as an inertia block. The block swings under the recoil of a shot being fired, and resets the trigger mechanism for the next barrel. The inertia block is what prevents you from dry-firing both barrels. No recoil, no re-set. Similarly, on the smaller gauges there may not be enough recoil to reset the mechanism. After all, the inertia block was adjusted at the factory to work with even the lightest 12-gauge load, which is much heavier than the heaviest .410 load.



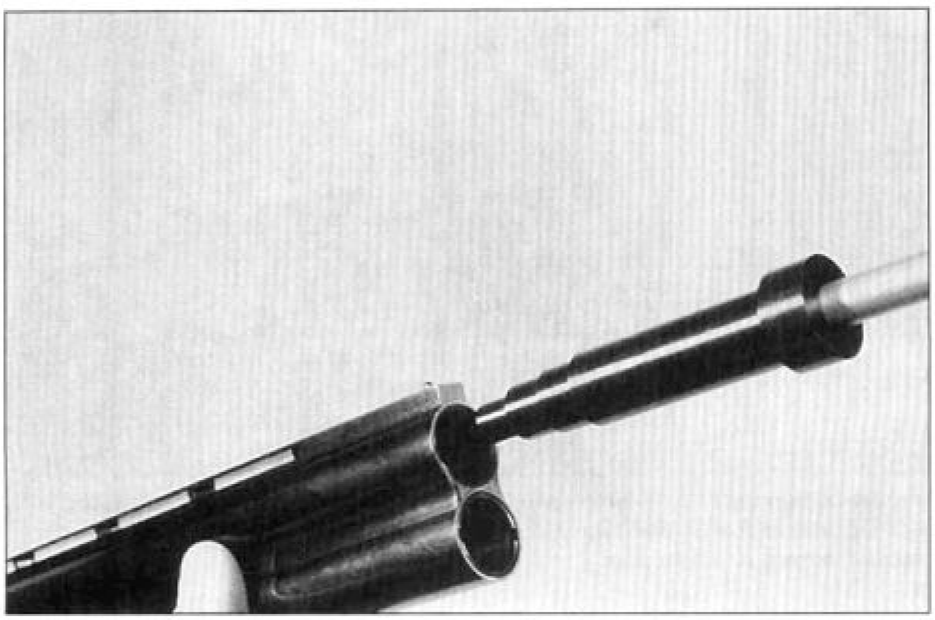
Use the Power Knocker to seat the tube into the bore.

In the event your double does not re-set for the second shot with the smaller gauges, do not work on the block yourself. Instead, call up Brileys and see about sending your shotgun to them. Adjusting the inertia block is delicate work, and best left to those experienced in it. For a nominal fee and

a fast turnaround, they will adjust your inertia block to work even with the .410 tubes in place.

New Tubes For Old

One application for tubes that I had not thought of is for old guns. Not just old shotguns that can't be fitted with screw-in chokes, but old guns that can't be shot with modern ammo. As I explained several times in the beginning, you should not fire a damascus-barreled shotgun with modern ammo. However, if you have a fine old Damascus barreled shotgun, you can drop tubes into it and use it. You won't be able to shoot 12-gauge shells from your heirloom, but you can use 20-gauge, 28-gauge or .410s in it.

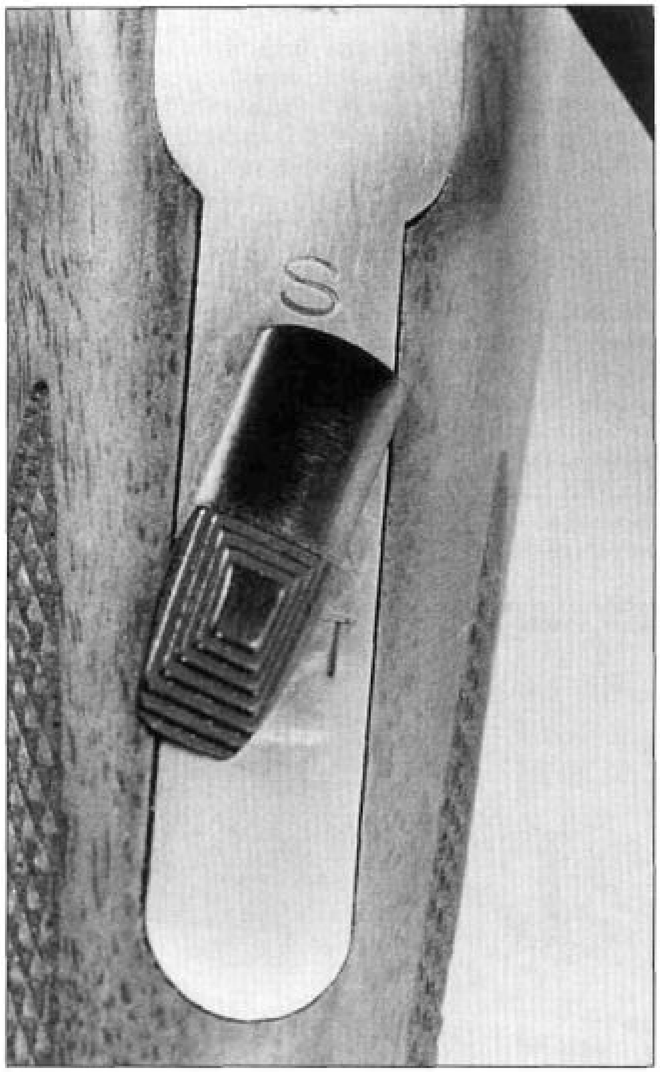


To remove the insert tube, insert the plastic end of the Power Knocker into the muzzle…

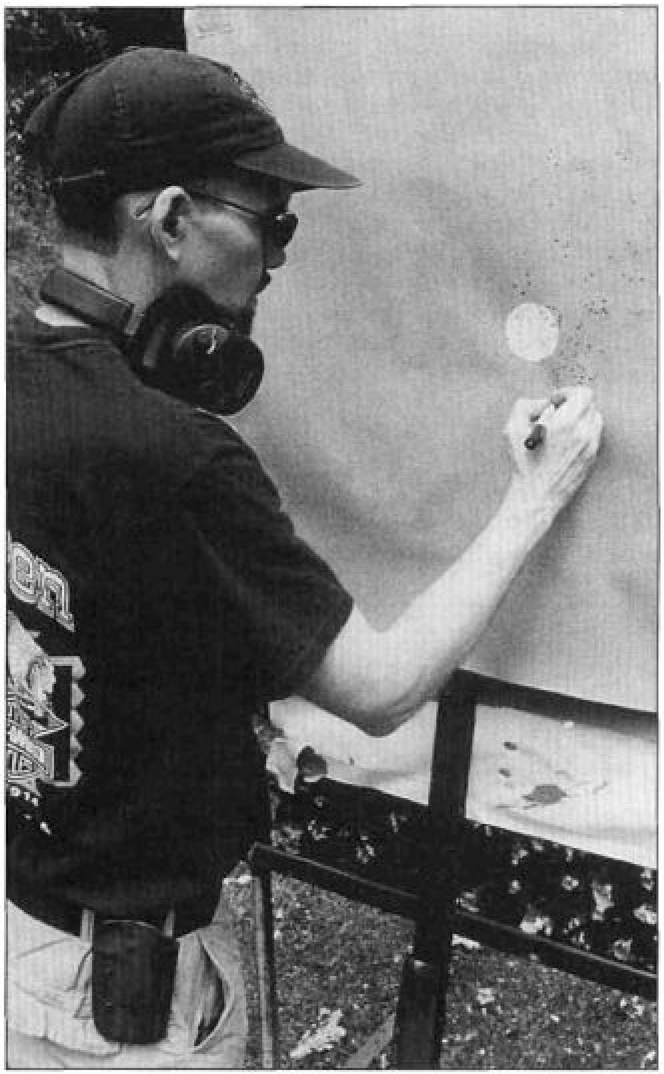
There are some caveats, however. To be considered a likely candidate, a shotgun has to be tight and solid. It must lock up tightly, without wobble or shake. The stock must be in good condition. If the wrist is cracked, or softened to a sponge-like state from decades of oil, it will not survive firing. Finally, it has to be comfortable to shoot. Many old shotguns have stocks that are too short, have too much drop, and have narrow combs. If you use the old shotgun with its stock design in the same shooting stance it was

designed for, you can shoot comfortably. If you use the old shotgun with a new shooting stance, you will be in for an uncomfortable experience, even in the smaller gauges.

…and knock the tube out onto a padded surface.



Try your selector and see if switching the order changes the gun's response to firing the second round. The Ruger Red Label has a mechanical re-set for the second barrel, and has no inertia weight needing adjustment.



An insert tube can keep your patterns centered, since you don't have to switch guns. Same gun, same fit, same pattern center.

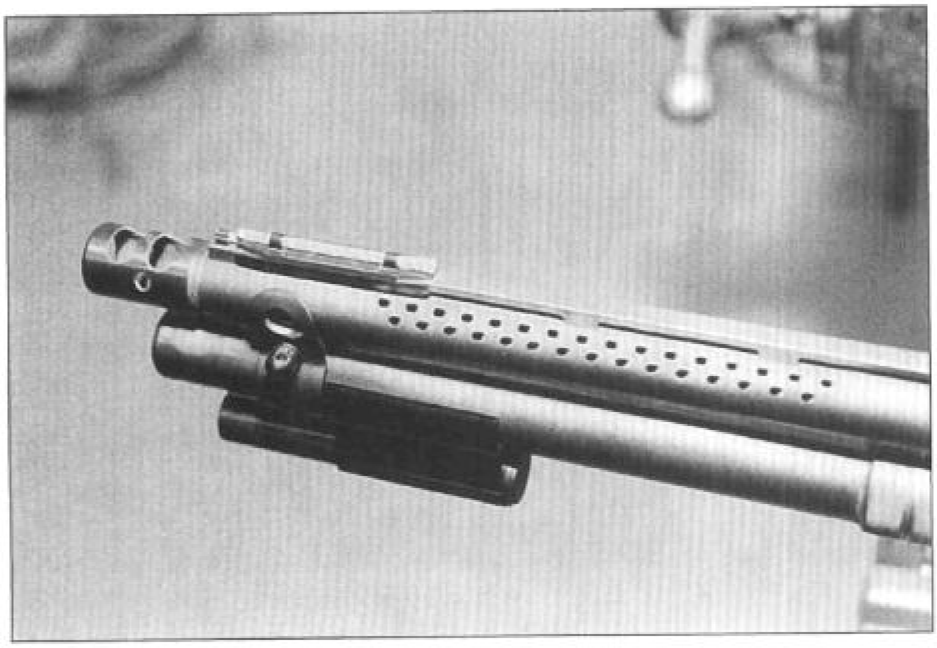
Chapter 9
Sights

"In the beginning, there was nothing." Genesis

Not only was there nothing when the earth was formed (regardless of how you think it came about), for a long time the ends of muzzles were bare. After all, accuracy was not something you could depend on, so why bother with any kind of aiming device? Once early firearms began to offer enough accuracy, some sharp dude had sights installed. On rifles the size, complexity and range of adjustment of sights evolved into marvels of utility, on shotguns they stayed the same.

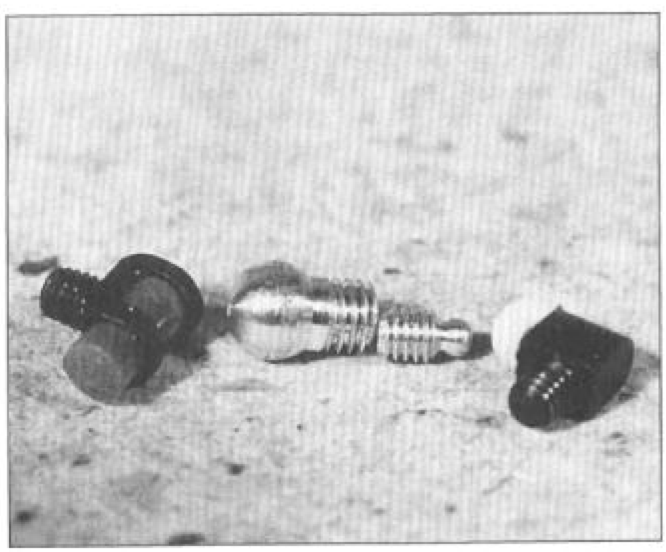
Shotguns have beads. The common method of installation is to drill a hole through the barrel, tap it for threads, and screw a round-headed little thingy into the hole. Common, but not the only method. Some beads are pressed or crimped into place. Remington shotguns with ventilated ribs have pressed beads, and replacing the bead can be quite difficult.

As the sole aiming aid, the bead sits out on your barrel exposed to the elements and abuse, asking only that you pay attention. The traditional choices of bead construction used to be brass, aluminum and ivory. Ivory was soon replaced by plastic, but the brass and aluminum ones soldier on. Brownells sells many thousands of replacement beads each year. Every time a barrel is shortened, or a shooter decides that the tiny little bead on his or her old shotgun is just too small, a new bead comes into the world. In the case of a bead being too small you can understand replacing it, but when a barrel is shortened, why not just re-use the old one? I tried re-using beads when I started gunsmithing. I ran into two problems: Beads had worn from use, and removing them marred them. Beads can be worn from sliding in and out of gun cases, from rubbing on duck blinds, tree branches and gun racks. A worn bead is not round. It may not be enough to change the point of impact, but a non-round bead is difficult to grasp for removal. Even when round, a bead may be marred when you turn it out. A marred bead cannot be reinstalled without looking like hell.



Getting a fiber-optic bead on your shotgun is as easy as using a magnet. This magnetized sight clips right to the rib.

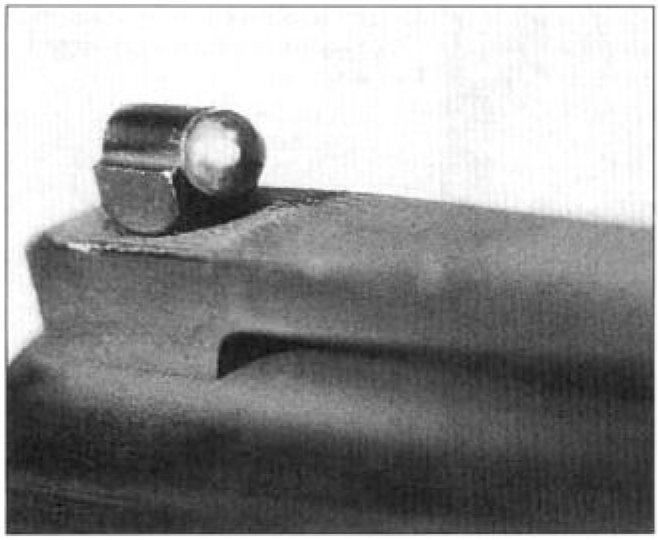
No, I quickly found out that the percentage or beads that could be re-used was small enough that trying wasn't worth it.



Standard beads are threaded to screw into tapped holes in the barrel or rib.

Brownells makes bead of many sizes, colors, materials and thread size. A professional would go through this box in a year. You might not finish it in a lifetime. Buy only what you need.

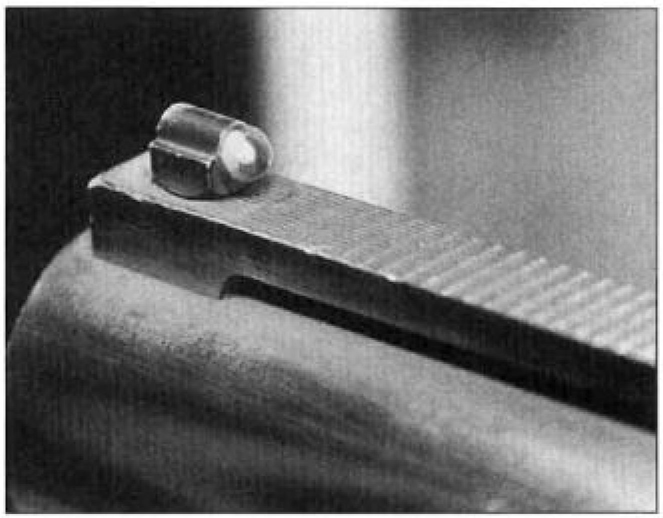
One change to the simple bead was to put it on the front face of a block on the barrel. Called the Bradley bead, it serves two purposes. The block raises the bead up from the barrel, lowering the center of the pattern without weakening the bead installation. The block also separates the bead from the sky. On a blue-sky day, a brass, aluminum or white plastic bead can get lost against the sky. White beads and a slight overcast can be particularly difficult. The block of the Bradley bead visually separates the bead from the sky. In dark viewing conditions, the block blends in, leaving the bead visible. On bright days the block stands out, leaving the bead surrounded by a dark halo. (Not all Bradley beads have a large enough block to stand out from the bead.) One common use of the Bradley bead is on barrels for the Browning A-5 and all its clones. The thickness of the receiver and the prominent hump on the back can often lead to a shotgun shooting high with a particular barrel. By the time you've lifted the muzzle enough to see the bead over the receiver, the pattern is hitting too high over the bead. To lower the pattern, the Bradley bead is just the ticket.



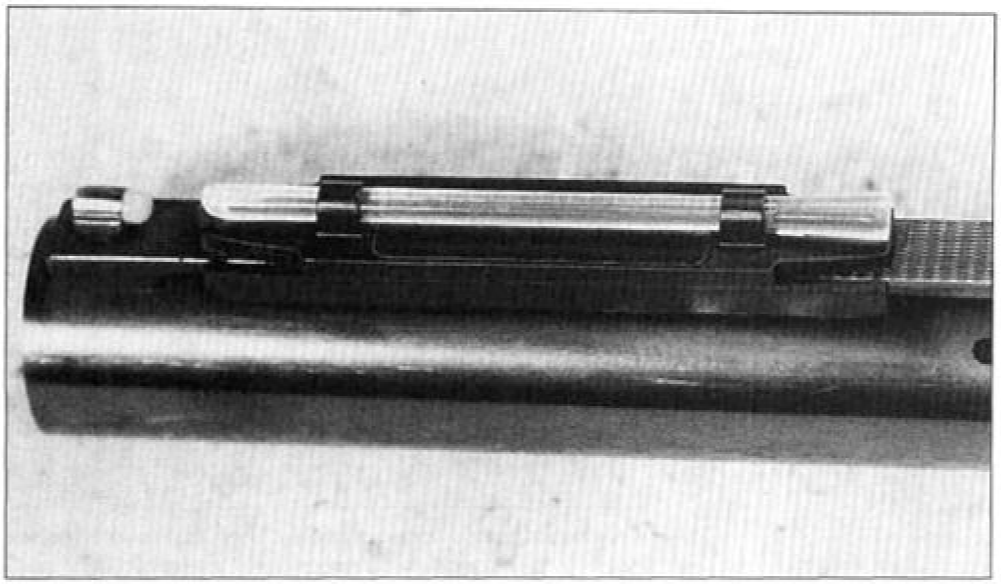
The Bradley bead is secured to the face of a block that screws into the barrel or rib.

***Fiber-optic sights help turkey hunters as well as wing shooters*.**

One change brought about by the plastic revolution is color. The plastic of the bead can be made a different color. Coloring plastic weakens it. The strongest form of plastic is that which is in its natural color. For many plastics, this is white. A bright red or orange bead can be more visible, but also more fragile. Protected and supported by the block of the Bradley bead, the plastic can be slightly weaker and still survive. Unless you are colorblind in those ranges, a red or orange bead stands out from the sky quite nicely.



***An orange-spot Bradley bead is easy to see against the sky, whether its blue or cloudy*.**

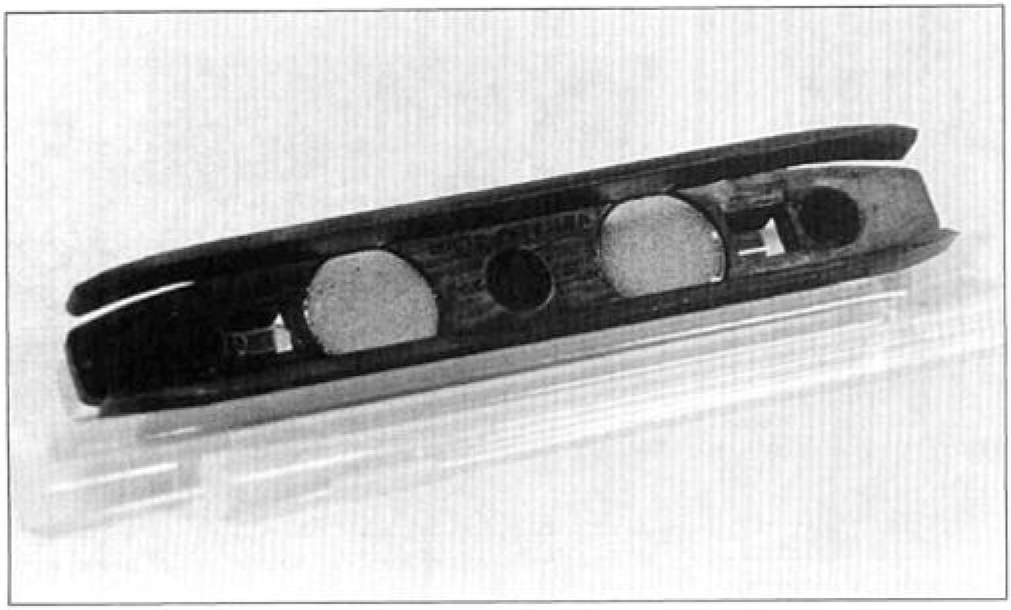


The magnetic clip-on attaches itself right behind the existing bead.

One popular plastic bead in color is the Raybar. It is a Bradley bead with the block drilled through and an orange cylinder fitted into the hole. The front of the bead gathers light, and the bead fairly jumps out at you even in overcast light. While not a fiber optic sight (it was designed decades before such things) it works very well.

The latest evolution in plastics for sighting involve the fiber optic principle, and fluorescent colors. A plastic or glass cylinder with the right diameter and smooth walls will reflect light down the cylinder rather than let it escape out the sides. First used for communications, the glass or plastic does not suffer from signal loss like copper or aluminum wires do. In the shooting application, the plastic can be used to both collect and then transmit light towards the aiming eye. The bright colors of the fluorescent dyes make the bright light of the optic “bead” stand out like a hobo at a dinner party.

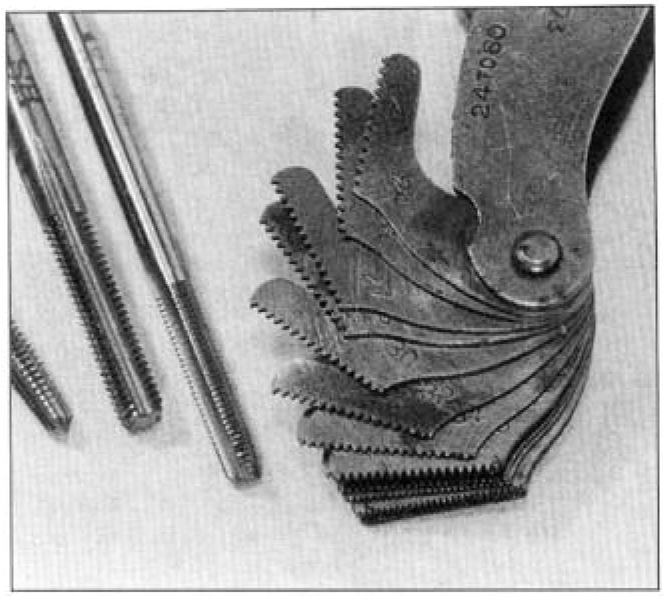
And as if the combination wasn't slick enough, the first of these “super glow” beads came as magnetized clip-on sights. The magnets are strong enough to stay on during recoil, and once slipped into place on your shotgun's rib the sight won't move until you pull it off.



You can see the magnets on the North Pass sight, and the extra rods of different colors.

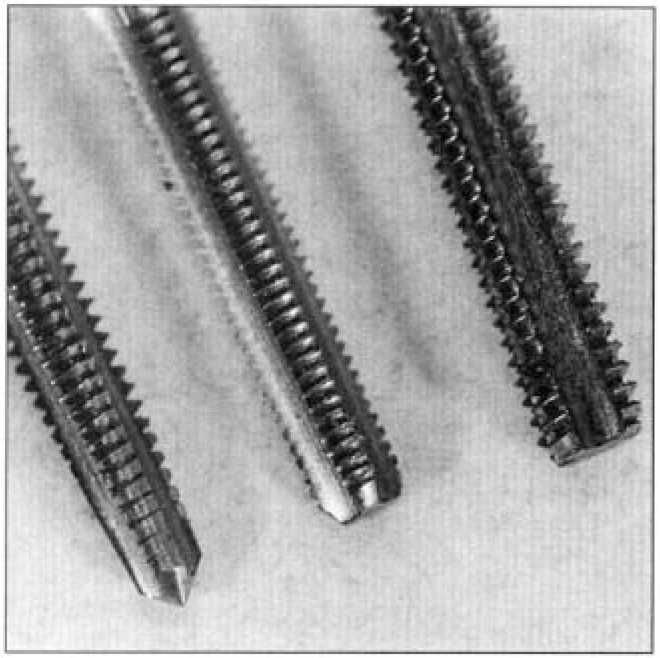
Bead Replacement

Changing beads is easy once you have the right tools. While quite a few older shotguns have beads that are not a standard thread, all replacement beads are now standardized, so you will have to change the threads in the older barrels. To change the thread size for the bead in the barrel or rib you'll need drills and taps. The two common thread sizes for replacement beads are 3–56 and 6–48. To drill the holes for those taps you will need drills in sizes #45 and #31, respectively. To fit the bead flush to the barrel or rib you may need a larger drill. All drilling must be done in a drill press to keep the hole vertical. Use masking tape to protect the finish of the barrel while drilling. Rotating a round bead is a tough job without the right tool. Open up your Brownells catalog and order a set of shotgun sight installers. These are specially-designed wrenches to grasp and turn beads. With them you will find the job a breeze. Without them you will not get beads fully installed without marring them. To secure the bead you'll want to use some Loctite. Once the bead is fitted to a non-ribbed barrel you need to file or grind the thread stub of the bead flush with the bore.

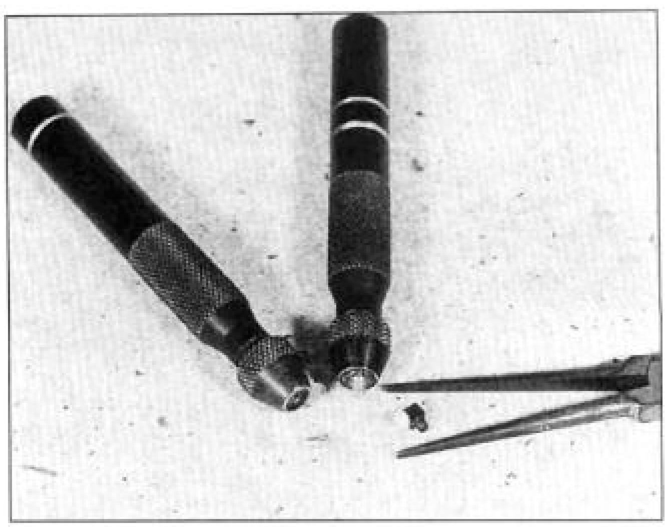


***Once drilled, you have to tap your bead holes. Or, replacing a bead, you'll have to clean the hole threads to a standard pitch*.**

There are two reasons to change a bead: Because you have to or you want to. Being brass, aluminum or plastic, beads get broken. A broken bead does you no good. If you decide you want to change to something that is larger or more visible, men you have to replace the old one. First, remove the old bead or the remnants of it. Removing a bead is easy. Unload the shotgun, remove the barrel and damp it in a padded vise. With a large pair of pliers grab the bead and unscrew it. The bead will be ruined in the process, so throw it away. Late-model Remington shotguns have a bead assembly that is pressed into the rib. Turning it will not remove it, instead, file the bead flush with the rib and use a centerpunch to mark the bead. Drill the bead out of the rib with your #31 drill. Remove the barrel from your vise and put a strip of masking tape on each side, and clamp the barrel in your drill press vise. When clamping, eyeball the current hole vertical. Use the barrel hanger as a reference to getting the barrel level and the hole vertical. Drill the rib, but do not drill into the bore.



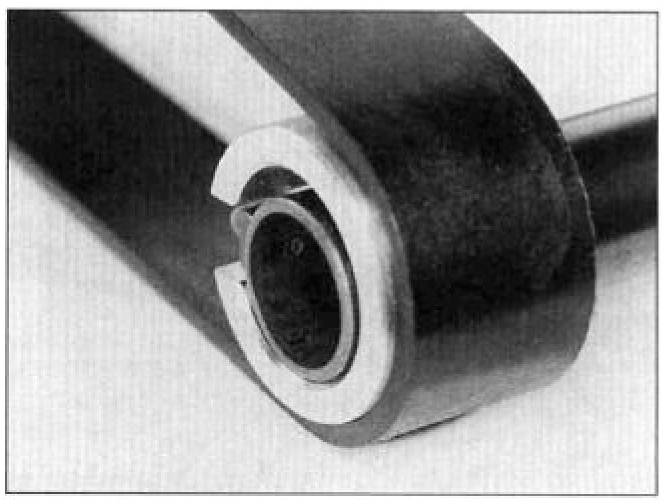
Taps come in three styles, (l-r) taper, plug and bottoming.



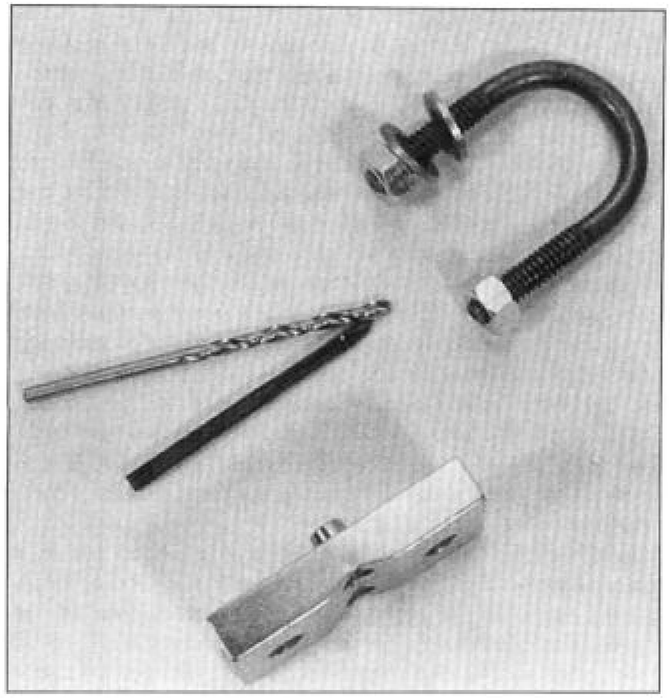
Brownells makes bead wrenches. For installing Bradley beads, you'll need to use a pair of smooth-faced pliers.

If you are enlarging the hole, again use the barrel hanger to gauge vertical, and run a #31 drill through the existing hole.

Even if the current threads are 6–48, you want to use your tap. On existing threads, use the tap to clean the threads of old thread-locking compound, powder residue and bent metal. The threads of the old bead may have left brass or aluminum in the threads during removal, and the excess metal will make screwing in your new beads difficult even with the proper installer. On plain barrels, run the tap through the barrel wall into the bore. On ribbed barrels, you drill a blind hole (no exit into the bore) and use a bottoming tap to cut your threads to the bottom of the hole. Physically, you can drill right through, even if you have screw-in choke tubes. (Be sure you remove the tube first!) However, as a matter of pride in craftsmanship, I always tried to not drill into the bore of a ribbed barrel.

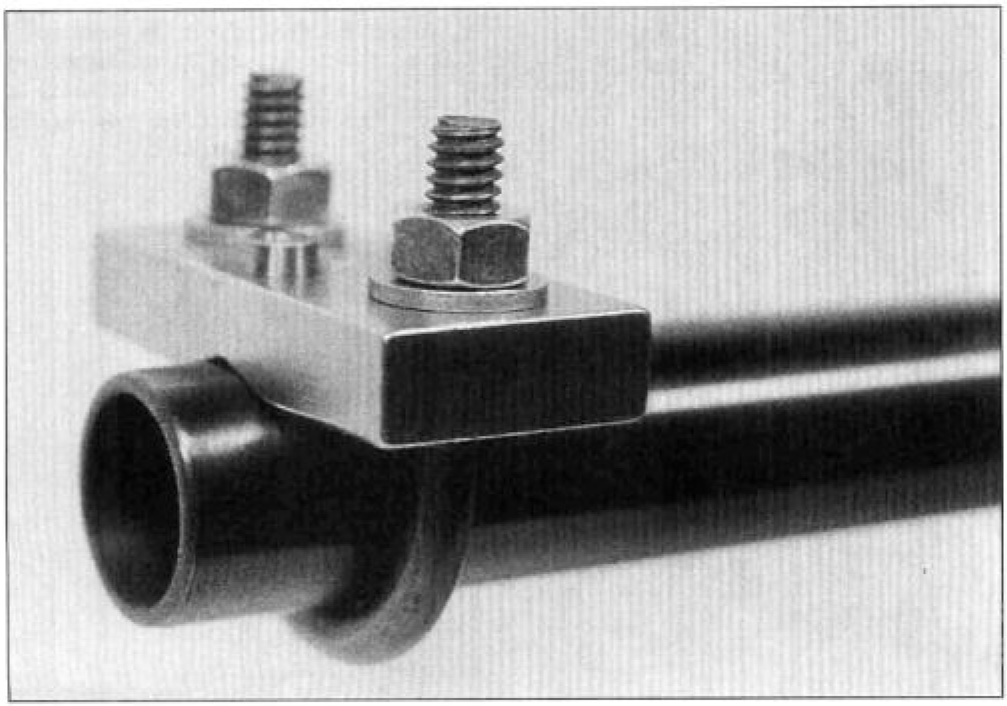


Plain barrels require the bead hole be drilled through the barrel wall.

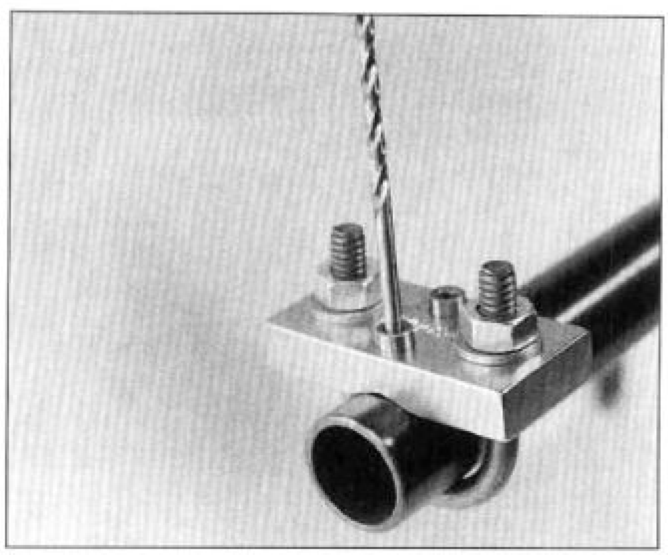


The B-Square barrel drilling fixture is a must-have for proper bead or sight installation on a plain barrel.

Leave the barrel in the vise. With the barrel drilled and tapped, select your bead. Lock it in the installer and screw it into the barrel. Remove the installer and look at the bead. Does the bottom of the sphere of the bead come down to the top of the barrel or rib? If not, you must pull the bead out and make it fit. A high bead is a problem partly because it shifts your pattern center, and mostly because it is more fragile. A bead at the end of a 28-inch barrel is 42 inches from your eye. If the bead is 1/10 of an inch higher than it should be, at 40 yards your pattern will be 3-½ inches lower than it was before. Considering that we measure a pattern by its percentage of hits in a 30-inch circle, 3-½ inches isn't much. But if you are using your shotgun as a slug gun, then 3-½ inches can be a lot. However, the big deal is the fragility of the bead. Perched up on its shaft, it is easily broken off.



Start by lightly clamping the fixture to the barrel…



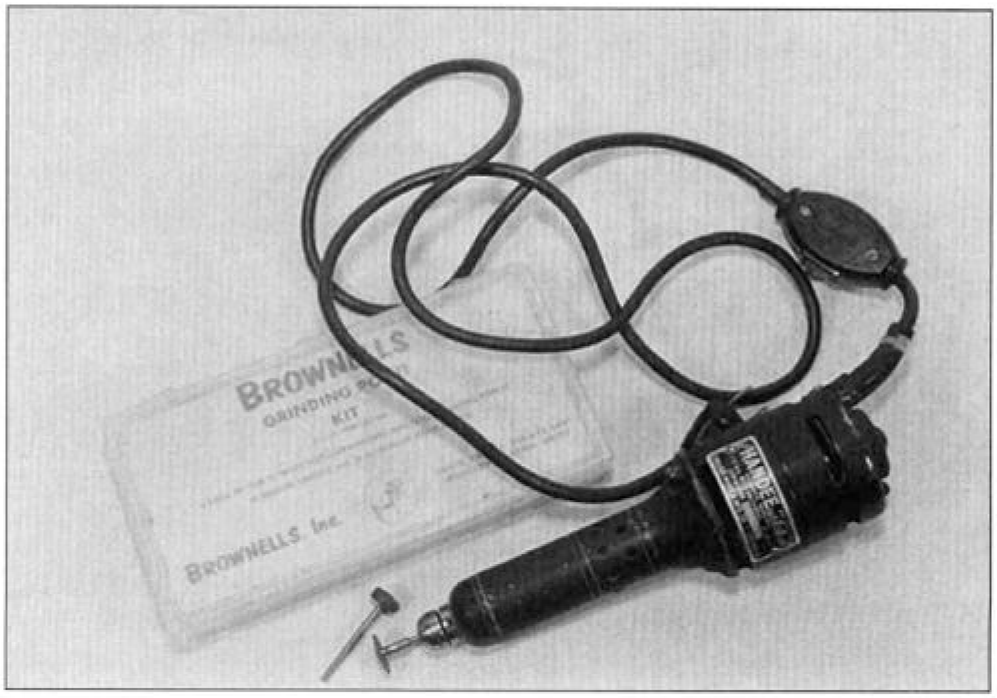
… and then place the drill into the guide. Shoulder the shotgun and adjust the fixture until the drill appears vertical when you have the shotgun shouldered. Then tighten the fixture and drill the

hole. Tap, and install your bead.

To get the bead flush takes either a tapping tool or a larger drill. Any gizmo to tap a bead would have to be custom-made and expensive. A larger drill is cheap. Lock the drill (a ¼-inch drill will do nicely) in the drill press. Leave the power off and bring the tip down until it just kisses the edge of the hole. Turn the chuck one revolution by hand. You are using the drill as a beveling tool to knock the edge off the drilled and lapped hole. Lift the drill and try the bead again. Repeat until the bead sits flush on the top surface of the barrel.

Truglo even makes a fiber-optic sight that snaps onto a plain barrel and doesn't require modifications.

Now that you have the bead fitting properly, take it out again. Degrease the bead and barrel and apply a drop of thread-locking compound to either the barrel or bead. Tighten the bead into place and remove the installer. On a plain barrel let the bead sit for a few minutes before continuing. On a ribbed barrel you are done. On a plain barrel you have to trim the excess bead out of the bore.



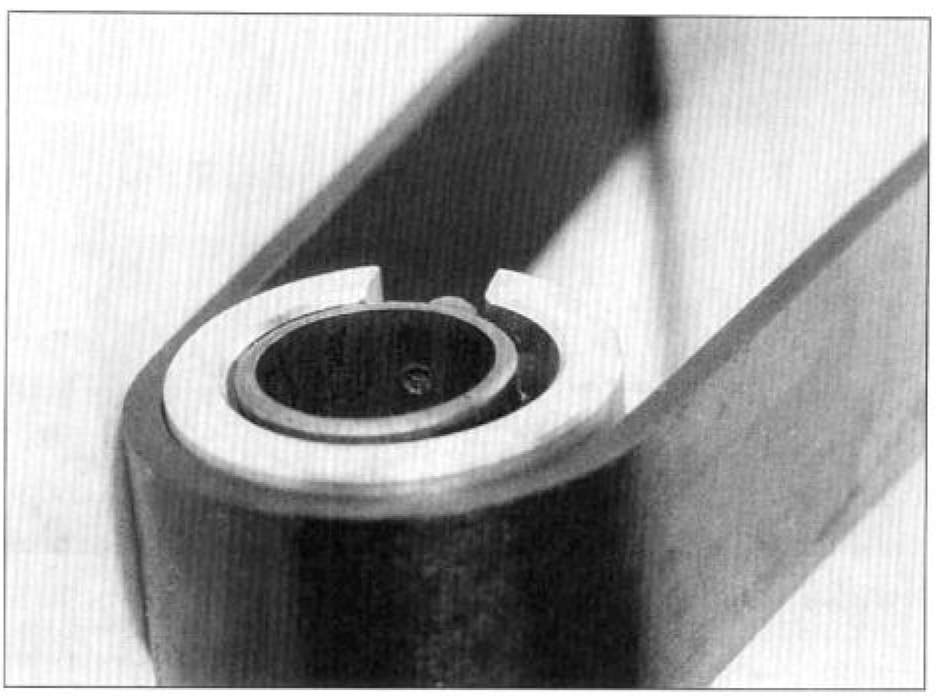
To dress down the bead stub, you can use a half-round or round file. Or, if you have a steady hand, you can use a hand-held grinder.

Take the barrel out of the drill press and put it in your padded vise. Lock it in place upside down, with the muzzle facing you and the bead pointing down. The slow and patient way to trim the bead stub is with round and half-round files. The bead is soft and it doesn't take much time. For those in a hurry and willing to take a little risk, chuck a sanding drum in your hand-held grinder. Put on your safety glasses, ear muffs and face mask. Brace your left hand against the muzzle and use it as a rest for your right hand and the grinder. Reach inside the muzzle and carefully grind the stub flush. The risks fall into two categories: heat and choke. If you overheat the bead you will burn out the thread-locking compound and your bead may not stay in

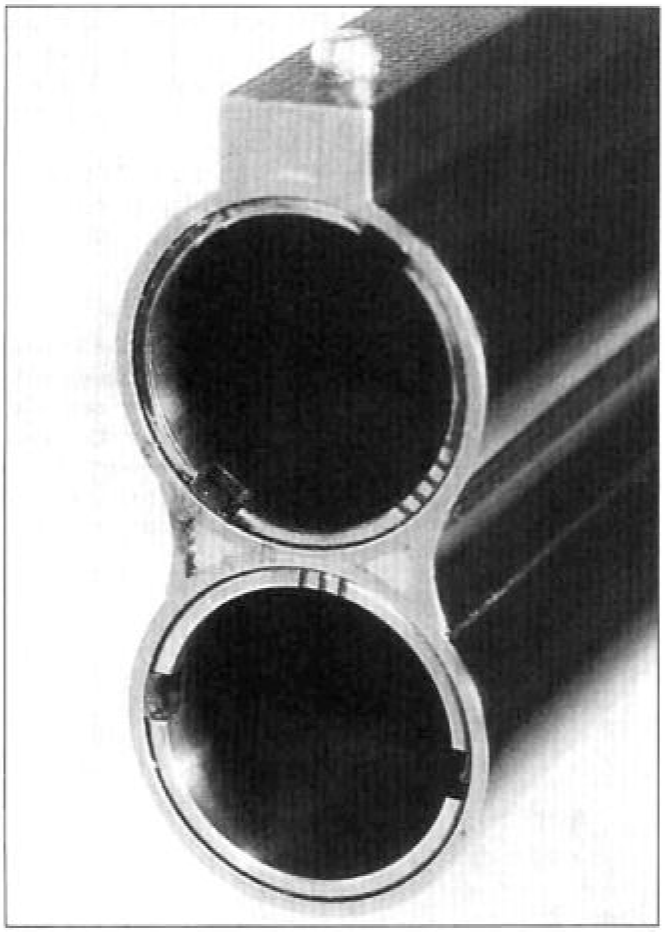
place. A damp cloth held against the outside of the barrel over the bead can draw the heat away. If you go too far and brush the sanding drum against the bore, you could alter the performance of the choke. The effect would be small, but in some cases it could be significant. The best method is to combine the two methods. Grind the stub down until it is almost flush, then use small files to get it flush and finish with the barrel hone to polish the choke.

What if you want to bring the point of impact down, but don't want to leave the bead sticking up exposed and vulnerable? The Browning A-5 is a shotgun where you could have this problem. If you shorten the barrel you can find your pattern shifting as much as a foot higher. Brownells makes a bead called the Bev-L-Block. The bead rests on the face of a block that you attach to your barrel. The block comes in two sizes, Hi and Lo. The Hi is ¼-inch high (.250″) while the low is 3/16 (.1875″). On the previously mentioned 28-inch barrel, the Hi can lower the center of your pattern 8-½ inches at 40 yards. The pattern can be lowered even more with shorter barrels.

If the bead stub isn't removed, your patterns will be disrupted, and you can damage the barrel from repeated firing.



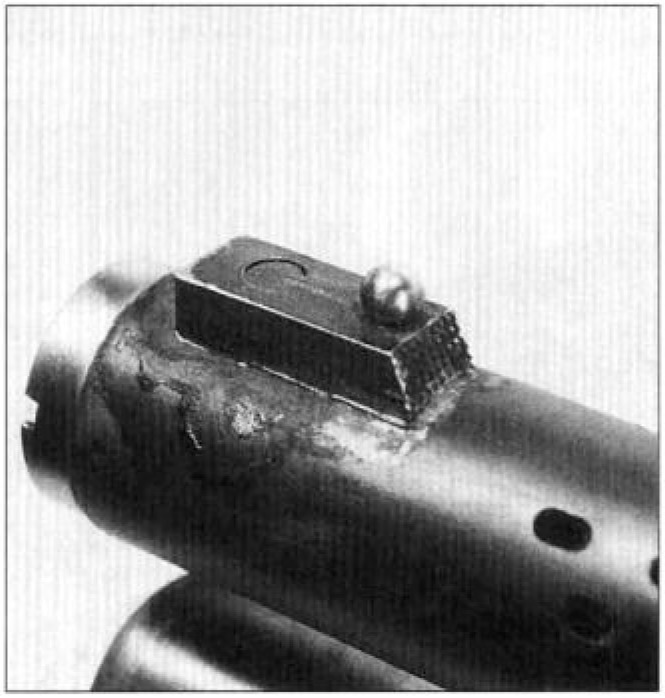
The procedure for installing the Bev-L-Block is the same as with any bead, except that you will not have to bevel or deburr the edges of the hole to get the block flush. You will, however, have to use a different drill size and tap. The Bev-l-Block comes with a .l46″-48 screw. You will need a ⅛-inch drill (.125″) and a .146″-48 tap.



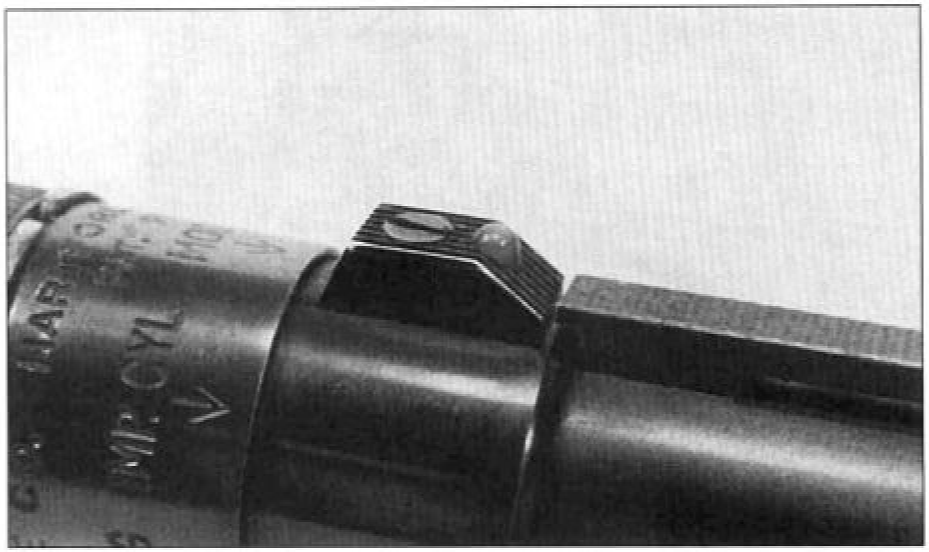
Installing a bead in a ribbed barrel, you don't drill through into the bore. You should remove the screw-in choke tube just in case the drill goes too deep.

Bradley beads (Bradleys, Raybars, and others of the block construction) pose a small problem in installation. The bead is set in the face of a small block that sits on the threaded shaft. It cannot be grasped with the bead installer, to turn the bead into its hole you must use a small, smooth-faced

pair of pliers. Grasp the bead from the top, not the front, or you will mar the corners of it. Turn in and fit as you would any bead sight, including beveling the edges of the drilled and tapped hole.



This Bev-l-block has been soldered in place, and will be cleaned up once the height has been adjusted for bead and pattern agreement.



*When Marbles installs a Poly-choke, they use a base much like the Bev-l-block***.**

Rib Beads

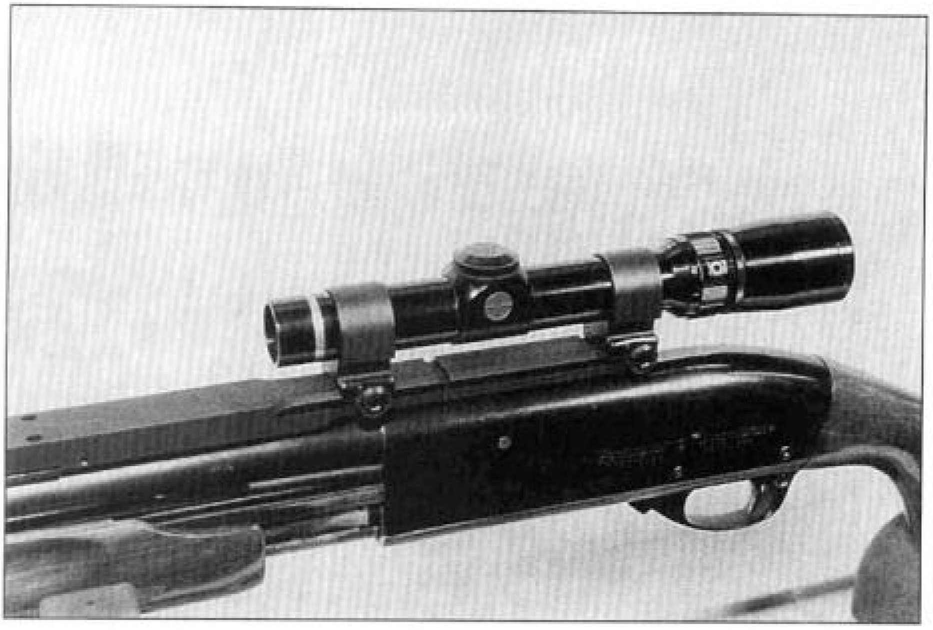
While the accepted wisdom of many decades of shooting holds that your aiming eye is the rear sight on a shotgun, many shooters use a mid-rib bead. The middle bead acts as an aiming check, and if your eye is too much out of alignment your subconscious will notice and correct. For trap shooters and practical shooting competitors, where the shotgun is aimed much more so than in other shotgun sports, the mid-rib bead is used as a rear sight.

The mid-rib bead, because it is closer to the eye, and is a secondary sight, is much smaller than the front bead. While a front bead can be .125″ to .175″ in diameter, the mid-rib bead is only .067″ in diameter. As you can imagine from such a small bead, the bead is threaded only in 3–56. A curious thing about mid-rib beads is that they only appear on ribs. Before the wise guys in the back go “Duh!” ask yourself this: If the center bead is so useful, why hasn't anyone figured out a way to fit one on a plain barrel? My only speculation on the matter is that the middle bead began as a serious competition gadget, and serious competitors used ribbed barrels. When the general population of shooters looked to upgrade, they went with ribbed barrels, and the middle bead came along. That, and a plain barrel looks goofy with another bead perched in the middle.

The mid-rib bead aids in aiming without being obtrusive. However, it is a poor replacement for a ghost ring if you are shooting slugs.

To drill the rib you need a rib center finder. It is possible to carefully measure the rib with dial calipers and determine the center, but the best method is to use a center finder. Made by Walker and sold by Brownells, the finder is beautiful in its simplicity. Determine the location of your mid bead. It should be about a foot to 14 inches behind the front bead, and on a rib post. Clamp your barrel in a padded vise at the mid-bead location. Place the center finder on the rib and twist it until the two locating bars are tight against the sides of the rib. Tap the centerpin with a hammer, and you have located your center and marked it for drilling.

The Remington rib is so sturdy you can mount a scope to it. This shotgun can have the barrels changed without changing the zero of the slug barrel.



The mid-rib bead is threaded 3–56, so you need a #45 drill. As before, protect your barrel with masking tape and clamp it in your drill press vise. Drill the hole into the post of the rib, but not through into the bore. Tap the hole 3–56, starting with a taper tap and then tapping again with a plug tap to get the threads deep enough. You needn't go to a bottoming tap as the post will have more height than the bead will have shaft. Lock the bead in the installer and screw it into the hole. Once you have determined that it will go in with the shoulder of the bead flush with the rib, unscrew it. Degrease the rib and bead and use a small drop of thread-locking compound to secure it. Screw it back in and you are finished.

The rib is intended to give your aiming eye a clear and distinct line towards the target. Rather than depend on your eye picking up the bead out on the end of the barrel, the rib draws your sight along the barrel and to the target. The original ribs were solid, some even an integral part of the barrel. The cost to produce such a barrel must have been quite high, as every shotgun maker went to the cantilever rib. The posts of modern ribs are soldered or brazed to the barrel after the barrel has been fabricated. On Mossberg barrels the posts are then machined to accept a rib that slides over them. The Mossberg rib is secured to a post only at one end, so as the barrel expands or contracts the rib is free to slide on the posts and adjust. The

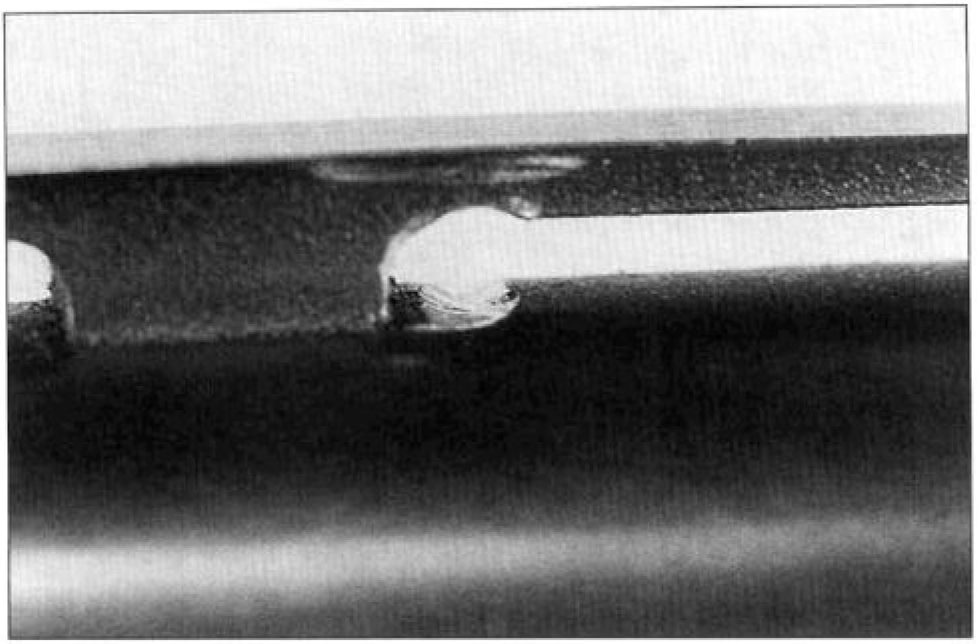
expansion of the barrel must not be too much of a concern, because Remington does it a little differently.

For practical shooting competition, a red-dot sight is a great help. How long before it becomes a sight on skeet and trap fields? Who knows.

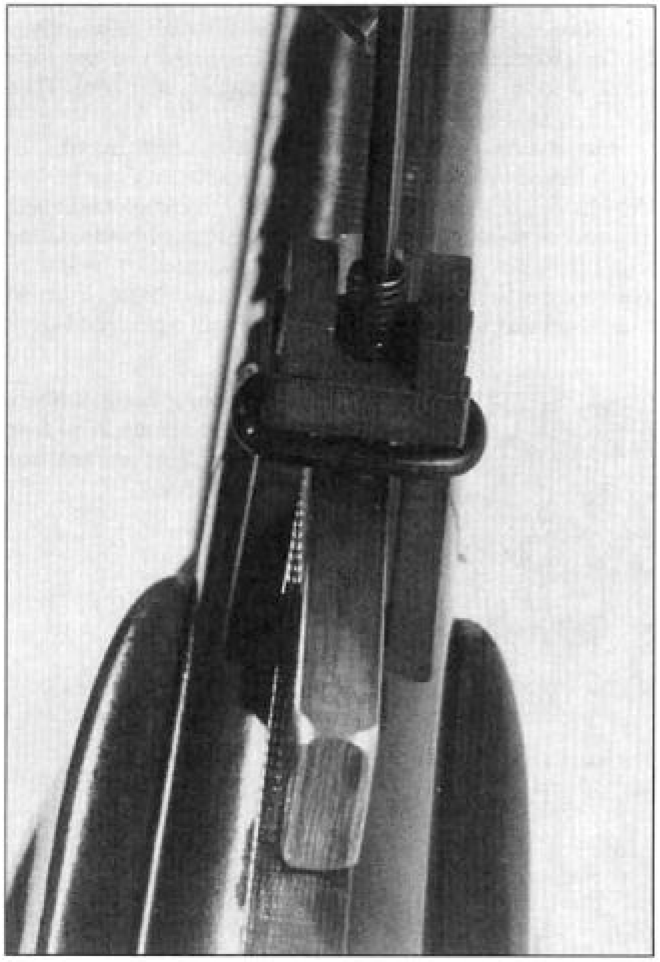
On a Remington barrel, the rib is machined with the posts integral to the rib, and contoured to match the barrel. Then the rib is soldered or brazed in place.

Modern mass-produced barrels with ribs have the ribs silver-soldered or brazed in place. As a result, they can be hot-dip blued. They are also highly unlikely to come unfastened. In years of working on shotguns that had seen hard hunting use, I have not seen a barrel with a rib fastened by high-temperature metal soldering where the rib came loose. Even on one barrel that had been split by firing with a plugged barrel, the rib stayed attached to the walls of the barrel. You will only have to re-solder ribs that have been soft-soldered in place. You will find such ribs only on imported guns or on doubles. If you have a pump or autoloader with a rib attached with soft solder and you want to try to re-attach it, you can try. If you have a soft-soldered double with a detached rib, do not try to re-attach it. The barrels, rib, and side or bottom plates are all soft-soldered on. The barrels are

regulated to hit to the same point by their attachment to the rib and side or bottom plates.



Remington ribs are tough. This one has been modified to hold an optical sight clamped to the rib.



***Remington ribs are so tough you can straighten them, rather than have to replace them*.**

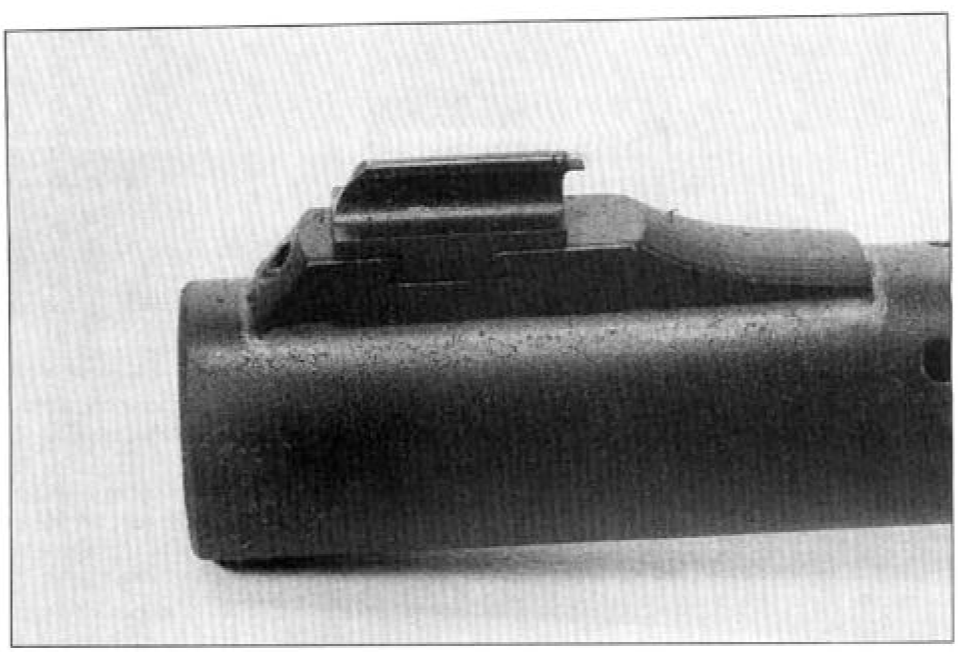
If you put too much heat into a soft-soldered barrel with a rib, you will loosen a couple of more posts. At that point, taking it to a pro to have him (or her, lets not be chauvinistic about this) will not cost you much extra. If you put too much heat into a soft-soldered double you could loosen the other plates and even disturb the regulation of the barrels. At that point, taking it to a pro will cost you a lot more than simply taking it at the start would have.

To re-secure a loose rib requires skill, patience and a steady hand. The best thing you can do is to send yours off to a specialist. If you have to try, buy a practice barrel. To re-solder the rib, place a strip of emery cloth under the loosened post and gently polish the post's base position on the barrel. You must smooth the surface and remove oxidation. Then, using a half-

round file as a backer, do the same to the bottom of the loose post. Apply soldering talc around the base, to prevent solder flow onto the barrel that must be cleaned off later. Apply flux to the bottom of the post and clamp the rib down to the barrel. Gently heat the barrel and post until you are up to the melting temperature of the solder you are using. Move the torch flame to one side of the rib post base, and touch the rod of solder to the joint on the other side. The heat will wick the solder through, only where the flux is. Let cool, remove the clamp, and clean up. If you have done it right, your rib is tight. If you haven't, you've loosened the next post or posts from excess heat.

The most common problem with ribs secured by high-temperature solder is denting. Tightly fastened to the barrel at many points, there is no give to the rib. If you bump it or knock it over, the rib is likely to take the hit and show the impact. If you attempt to simply pry the rib up, you'll end up with a wavy spot instead of a dent. Many shooters don't fix it because they don't see it. Intent on the bead and bird, they simply don't notice that the rib has a dent in it. To properly lift the dent you need the right tool. Available from Brownells, it is called Murray's Vent rib tool.

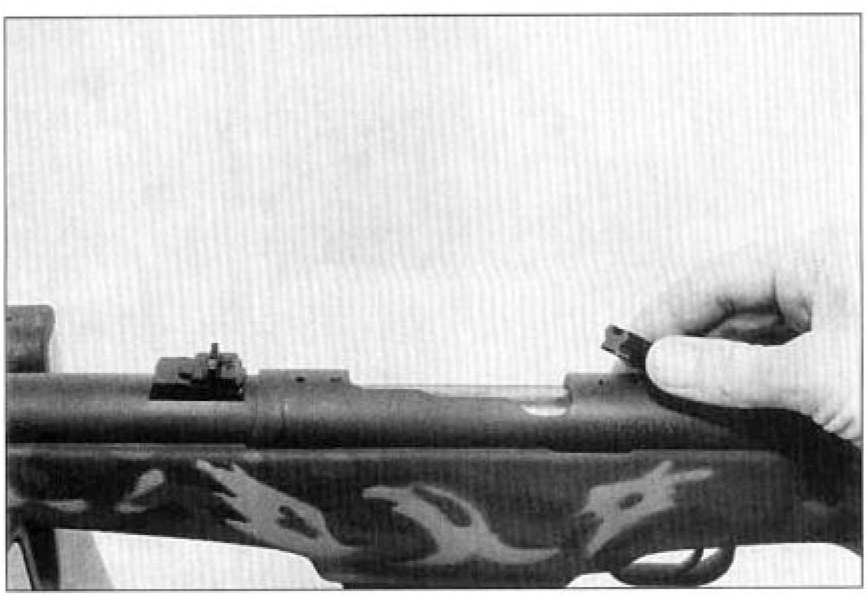
Slug shooting requires more than just a bead. The front sight on this slug gun is just like a rifle sight.…



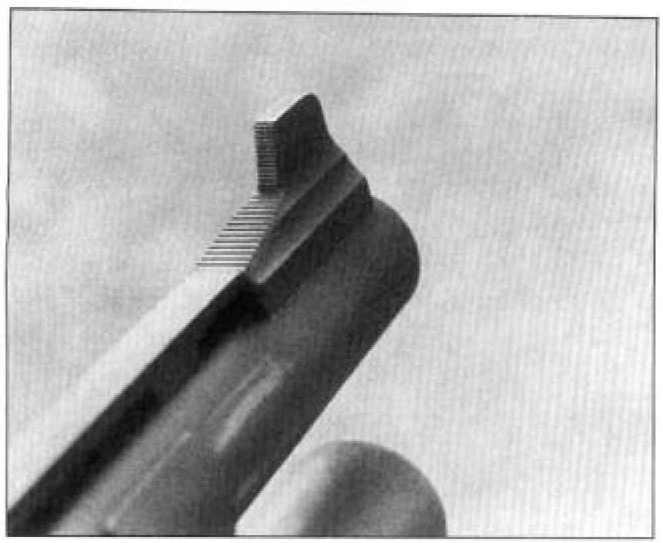
Not all shotgun shooting is done by the “cloud of shot” method. Sometimes you actually aim. While a bead or double beads can serve this purpose, a proper set of sights is a lot more useful and fun. Called “rifle sights”, they are simply adjustable sights fastened on a shotgun barrel. Before rifling in shotgun barrels became known, there were shooters who assumed rifle sights meant a rifled bore and rifle accuracy. The sights themselves do nothing to improve accuracy, just your ability to use it.

When the subject comes around to proper sights on a shotgun, the assumption is almost always that the sights are used to aim and launch slugs. Not always, as sometimes buckshot is used. The question always comes up: How do you sight in a shotgun, and at what range? The distance question is easy. If you are using iron sights, sight in at 50 yards. This is the maximum distance many shooters can see well enough (and many shotguns group well enough) to responsibly take game. If you are using a scope, then your distance is dictated by accuracy and trajectory. An accurate shotgun shooting Foster slugs would have a maximum range of 75 yards, limited by the looping trajectory. A shotgun shooting sabot slugs accurately can stretch the zero distance to 100 yards, and if you know the trajectory from practice, stretch the useable distance to 125 yards.

…as is the rear sight.



The easiest and quickest method of sighting-in is to start with a large section of bare hill at 25 or 50 yards. Select an aiming point on the hill and have an assistant or fellow shooter watch. Take one shot, and correct if necessary from the strike on the hill. Once you have your shots hitting the hill close enough to your mark that they would be on paper, switch to a paper target and zero just as you would with any other rifle. Why the hill? I have seen shotguns with slugs strike far off the sights. Shotguns can be very particular about the slugs they like and dislike. Some shotguns can shift the point of impact a foot or more by changing brands, and groups can fluctuate wildly in size. Once you find what your shotgun likes, stick with it. Do not buy something just because it is on sale, or because your brother-in-law recommended it, without testing it on paper.

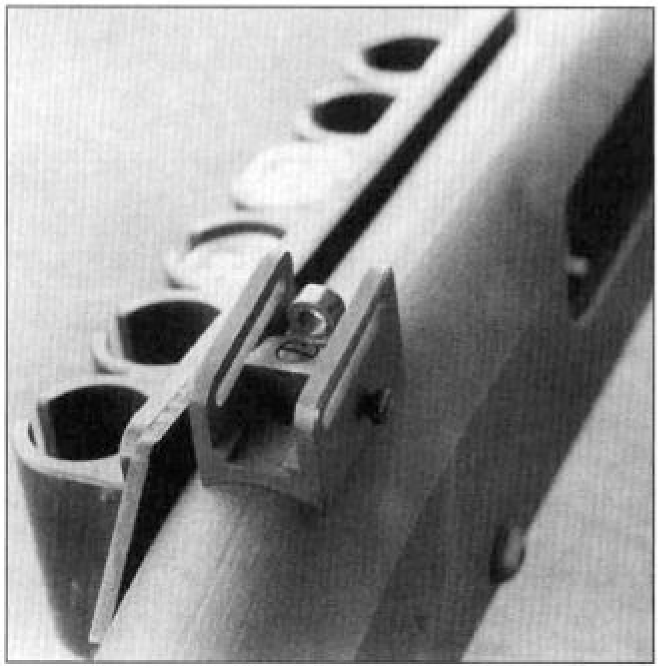


***Gunsite attaches a solid blade, soldered on by its large base, to provide a durable aiming device*.**

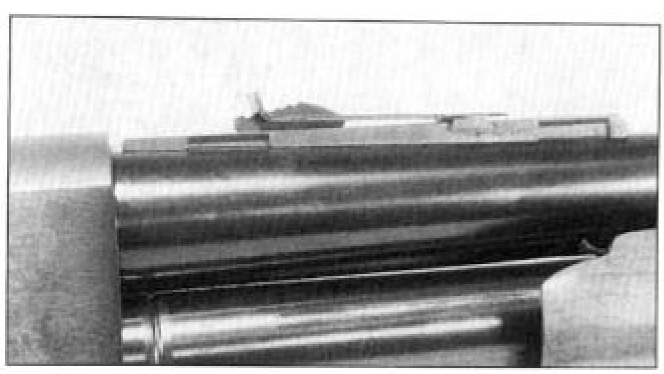
The standard rifle sights usually (almost always) come on a short barrel, usually 20 or 21 inches. The intended use for these guns is deer hunting and defense. A longer barrel would not serve any purpose. But you have to use the right barrel. Rifle sights on a barrel that is rifled can deliver rifle-like accuracy, once you find the load it likes. But the rifled bore will scatter buckshot and bird shot uselessly. The rifling spins the wad and shot, and the spun shot (deformed, too from the rifling) sprays out of the muzzle in an

uncontrolled manner. At 10 yards you may not have any pellets in a 30″ circle. Rifled bores and shot do not go together.

Not everyone wants to buy another barrel to go deer hunting. However, the beads just aren't good enough for accurate aiming of slugs. To improve aiming, several manufacturers make sights that will bolt or clamp to your rib and give a useful approximation of rifle sights.



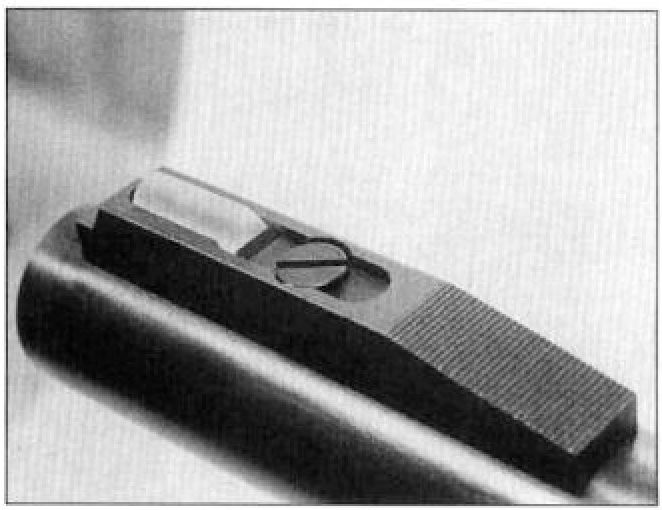
The Gunsite shotgun includes an aperture rear, solidly attached and protected by strong wings.



The Ithaca rear sight is simple, strong and up to the task of accurately shooting slugs.

Remington offers a TruGlo sight that uses double-sided adhesive tape to hold the sights in place. Just degrease the rib, apply the tape and then apply the sights. The problem with this approach is that it is neither adjustable nor removable. You can't go back to the bead sight without destroying the tape and having to replace it later.

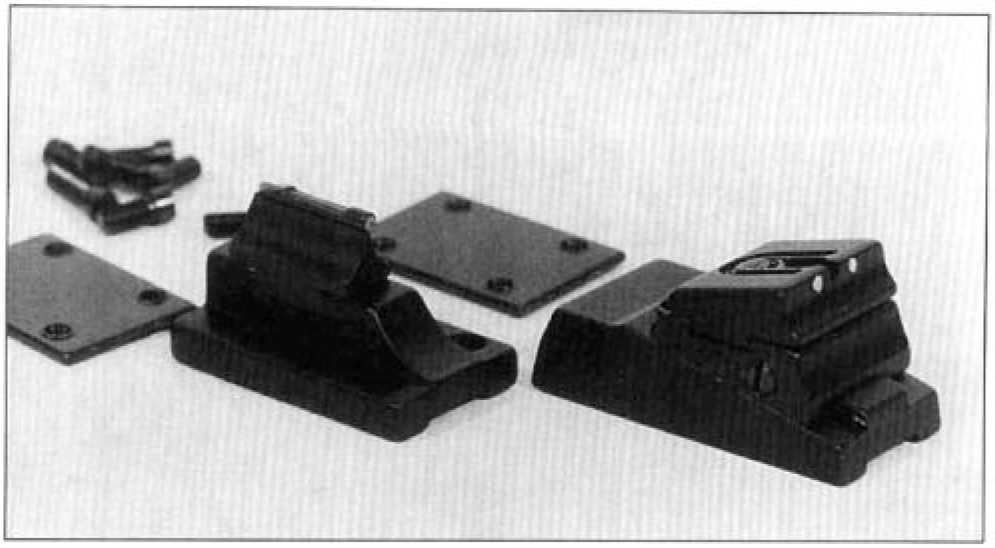
Williams offers several rifle sights for your rib that require drilling and tapping the rib to install. For each one, measure the hole spacing on the sight, and mark your rib on the centerline. Drill and tap the holes (usually 6–48) and fasten the sights. When you are done with deer season, unscrew the sights and use plug screws to fill the holes. When you need the rifle sights again next year, remove the plug screws and re-install the sights.



The Ithaca front sight is a bright orange plastic pyramid. Again, simple, durable and extremely useful.

But not everyone likes the idea of putting holes in the rib of their barrel, Accura-site makes a rifle sight that clamps around the rib. You can install it and remove it without leaving marks on your rib, and certainly without having to drill ugly holes in it. Measure the width of your rib and select the appropriate installation site. Degrease the rib and loosen the clamping screws of the sight. Check the sight for fit on the rib, and if it is correct, then put a small drop of thread-locking compound on the top center of the rib where each sight will go. Tighten the clamping screws. The Accura-sites

are adjustable for windage and elevation. On your next range trip, take the correct-size screwdriver with you and sight in your new slug barrel. When you are done for the season, loosen the clamping screws and leave the sights where you will be able to find them for next year.



The Williams Gun Sight Fire Sight clamps right to the rib. It provides all the benefits of fiber-optics, adjustable sights and is easy to install.

If you have a plain barrel you want to turn into a dedicated slug barrel. Accura-site makes a rifle sight for round barrels without a rib. Instead of the temporary clamping method, it uses permanent Poly Choke® adhesive. The adhesive is designed for use on rib installation, and does not set hard like so many epoxies. Instead, it sets up with a rubber-like firmness, and can flex with vibration and temperature without losing hold. With the adhesive, your sights are on until you take great efforts to remove them.

Ghost Rings

The ghost ring is a large-aperture rear sight. Your eye will automatically center itself viewing through a circle if you let it. The ghost ring is small enough that your eye can see it and use it for aiming, but large enough that it "fuzzes out" or becomes indistinct. You aim through a ghost ring, and focus on your front blade or bead. To work, a ghost ring sight cannot be installed on a rib, and thus cannot be a temporary installation. On the rib it

would be too far from your eye, and within the range of focus that the front sight is in.

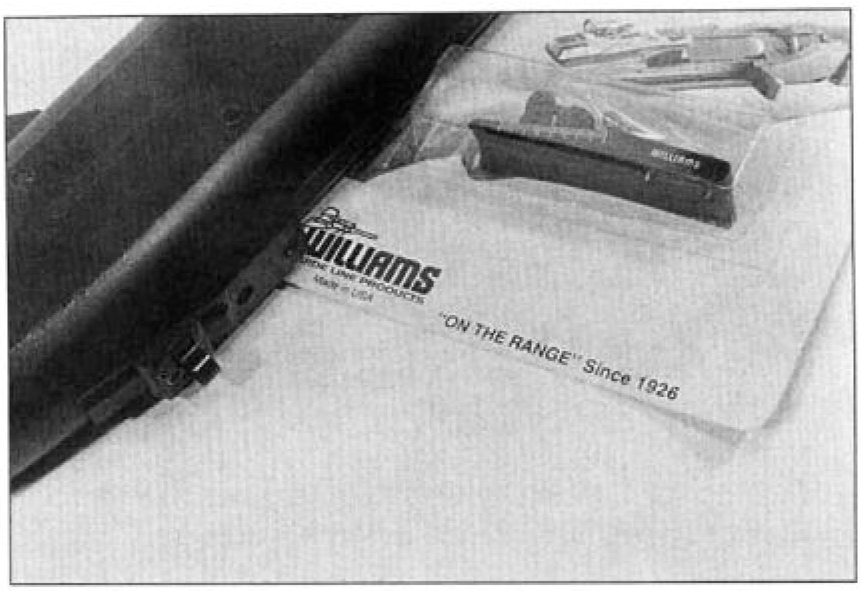
Mec-Gar makes a first-class ghost ring rear. You must drill and tap your receiver to install it.

You can get a ghost ring rear sight from Mec-Gar, or a front blade and rear ghost ring from MMC, Sage International, Trijicon and Scattergun Technologies. When I first read about the use of the ghost ring from the writings of Jeff Cooper, these later sights had not yet been made. I installed what was known then as the Williams Guide sight, now the Williams WGRS. For my Remington 870 I selected the WGRS 742, and found the curve of the sight matched closely the curve of the rear of the receiver. It is a small and unobtrusive installation, unlike the aperture side-mounts offered.

To install any of them is simple. You'll need drills and taps for the installation screws of your sight. As the screws are probably 6–48, you'll need a tap that size and a #31 drill. You'll need a drill press, dial calipers, layout blue and a center punch. Check to make sure your shotgun is not loaded. Disassemble it and strip all of the action parts out of the receiver.

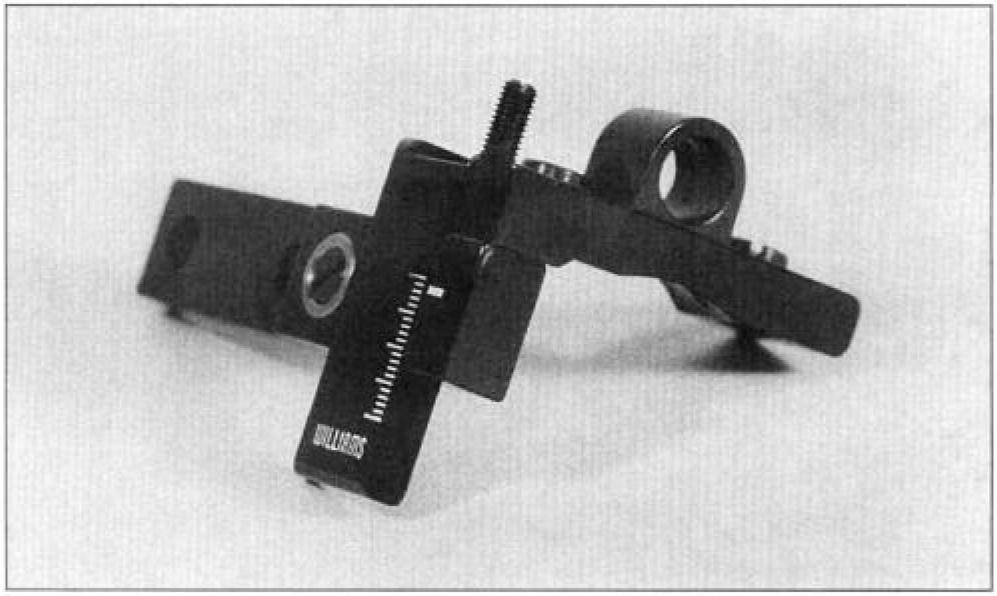
Run a stripe of layout dye down the centerline of the receiver. Measure the width of the receiver and divide by two. Set your dial calipers for the half-width and lock them there. Lay the receiver on its side at the edge of a flat level surface and use the dial calipers to strike a line in the layout dye. Turn the receiver over and strike a line from the other side. The two lines should coincide. Now clamp the receiver in your padded vise and determine the rear sight location. As universal sights, the bottom of the sight will be flat. You want your sight as far to the rear as you can get it and have it supported by the receiver. You do not want your sight hanging out over the curve of the receiver.

The Williams Guide Sight was my original choice for a ghost ring. It works, but its aluminum construction is not as durable as a steel unit would be.



Once you have your sight location selected, look at where the screw holes are. Mark the sight location with a china pencil if you have to. Now look inside the receiver and see where the screws will come through. The particular culprit for difficult screw location is the 1100. The long barrel extension comes back into the area where the screws will be. You cannot drill your hole through the edge of the recess for the barrel extension. The drill will wander, and maybe even break. Even if you get a clean hole, the tap will till and cut uneven threads. The screw will turn in at an angle, and

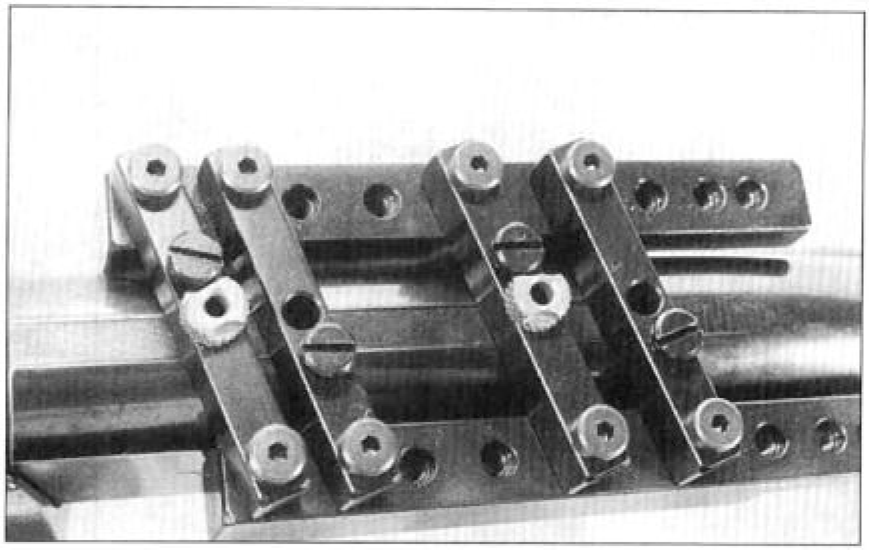
not be secured. It will be a mess. If you find that your initial location will require a screw hole right at the shoulder, slide the sight forward or back. If you are already back against the curve, then forward you go.



Not all ghost ring rear sights attach on the top of the receiver. This one requires drilling and tapping the side of the receiver.

Mark the screw hole locations with a scribe, reaching through the holes in the rear mount. Then use the center punch to keep the drill on location when you begin drilling.

Drill and tap the receiver. Deburr the edges of the hole and use the screws to fasten the rear sight in place. Take the receiver out of the vise and turn it over. Do the screws protrude into the receiver? If they do you must trim them flush. Look closely and count the number of threads sticking out. Unscrew it and use a screw holder to keep the screw under control while you file or grind the excess off. Leave the rest of the parts out, but install the barrel and look at your sights. Is the rear sight level? If not, you will have to either shim the base, or file the receiver. On Remington shotguns the sighting groove is meant for the eye, not the ghost ring. The edges of it may not be level. Some careful work with a fine-cut file will lower the higher edge and bring your rear sight level. However, most will be fine.

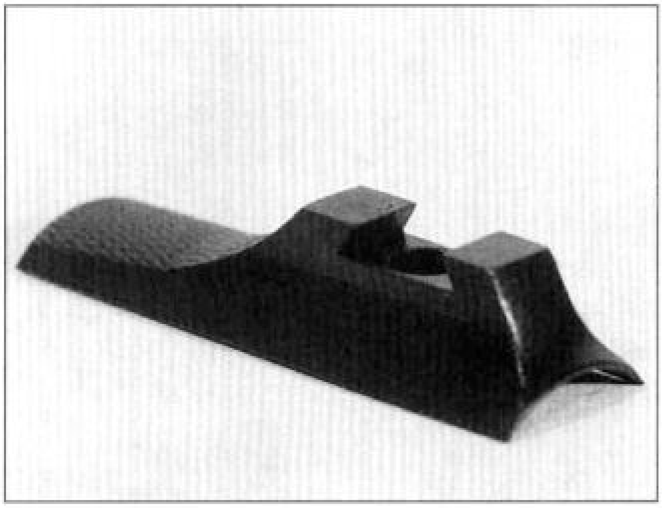


The Williams drilling fixture gets your holes properly spaced and on the centerline of the receiver.

Remove the screw and degrease the sight and receiver. Use a thread-locking compound to secure the screws when you install the ghost ring.

Putting a ghost ring on a Browning A-5 or Remington M-11 can turn it into an accurate and dependable slug gun for deer hunting.

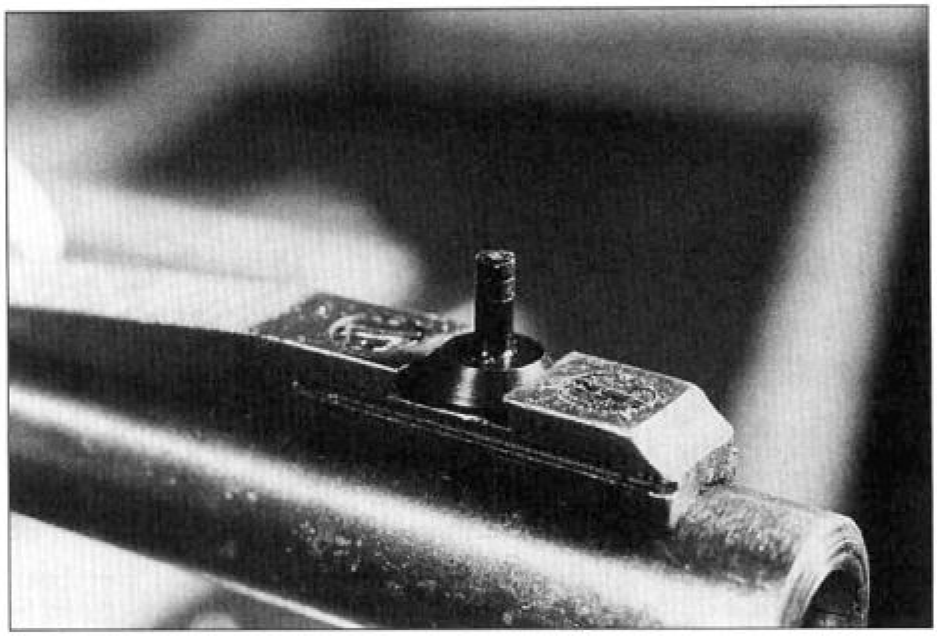
The front sight on a ghost ring setup is a blade sight. While the typical barrel used with a ghost ring arrangement is a plain barrel, you can use a barrel with a ventilated rib. On the Remington 1100 I used at Gunsite, I used a vent rib barrel. To install the front blade, I used a Clark front sight meant for handguns. The Clark requires a dovetail. The barrel is a vented rib barrel that had been shortened right at a post, leaving the rib ending in a small block. I clamped the barrel in a mill and leveled the rib. I then milled the dovetail, from the muzzle end. Once fitted into the slot, I took it to the range with a file and filed the sight down to zero the barrel with slugs.



If you want to install a blade front on a plain barrel, you'll need a front sight base like the Williams Gun sight base. It can be held on with a screw or soldered in place.

The dovetail took out too much of the joint between the rib and the post, and the rib lifted after a weekend of practice and zeroing. I used a welder to tack the rib and sight in place, and filed it flush. If I was to do this again, (or if you are to do it at all) I would change the procedure slightly. Instead of the dovetail, use a plain blade. Drill the rib as if for a bead, but instead use a threaded hut non-headed screw shaft. With the shaft as a temporary front sight, zero the shotgun with slugs by clipping the screw shaft shorter with a pair of sidecutters. Once you know how high the blade is to be, use a mill to cut a slot the width of the blade into the rib from the muzzle. Fit a blade as high as your modified screw was, and secure it with a cross pin or by tacking it on the front face of the rib.

To determine the correct front sight height, you can make a temporary front sight from masking tape, or use this plastic one from Ashley Outdoors. Cut it until your slugs are on paper, then buy the correct-height steel blade.

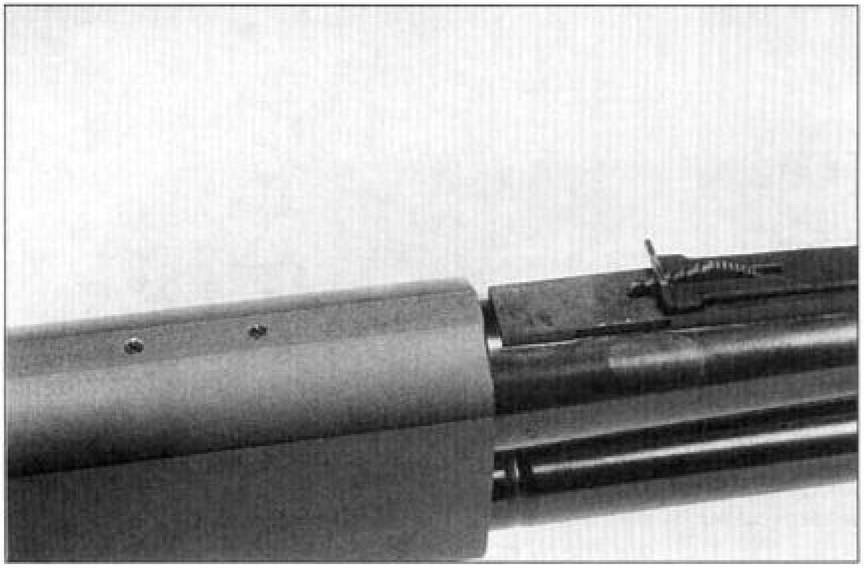


Once welded, my barrel went through the week-long shotgun course at Gunsite without a problem.

Scope Mounts

There are two places to mount a scope on a shotgun, the receiver and the barrel. On a rifle, the idea and need to mount a scope on the barrel is hardly ever considered, except when building a Scout rifle. The barrel is tightly screwed into the receiver of the rifle, and will not shift position. On the shotgun, the barrel slides into the receiver and is held in place by a nut over the end of the magazine tube. The barrel of the shotgun is free to shift around. When the nut is lightened down, it is easily lightened to different pressures, and the barrel may not be clamped the same each time the barrel is attached. On some shotguns attaching the scope to the receiver is not much of an accuracy improvement. If the barrel is a loose fit in the receiver and slops around before the barrel nut is tightened, you don't want to attach the scope to the receiver. However, if the barrel is a tight fit in the receiver, and does not move around much even before the barrel nut is attached, you can get quite satisfactory accuracy. How satisfactory? I have seen shotguns that deliver groups of 6 inches at 100 yards with a scope attached to the receiver. Accuracy that good is good enough to be used hunting or in slug competitions like the BCBC at Second Chance. (The BCBC course is

falling steel plates out to 90 yards, that you have to knock down as fast as possible. Far from a “spray and pray” course, it takes an utterly reliable shotgun that delivers excellent accuracy in order to do well.)



Many shotguns now come from the factory already drilled and tapped, like this Ithaca M-37 Slug Special.

The simplest method of attaching a scope to your shotgun is with a clamp-on mount. The clamp-on or “saddle” mounts fit against or over the receiver and use the trigger mechanism dismounting pin holes to secure the mount. The original designs were flat plates bent at the top, and clamped against one side of the receiver. Made of aluminum, they were not very satisfactory. The soft aluminum was not rigid enough, and the screw holes had to be large enough to fit any particular shotgun of a model. The end result was too much movement for accuracy. Not to leave a good idea alone, the manufacturers improved the design to fit over the receiver and clamp on both sides thence the “saddle”). With the mount secured and compressed from both sides, the movement is minimized or eliminated.

Remington and B-Square both make saddle mounts that clamp on the receiver and provide a place to mount a scope.

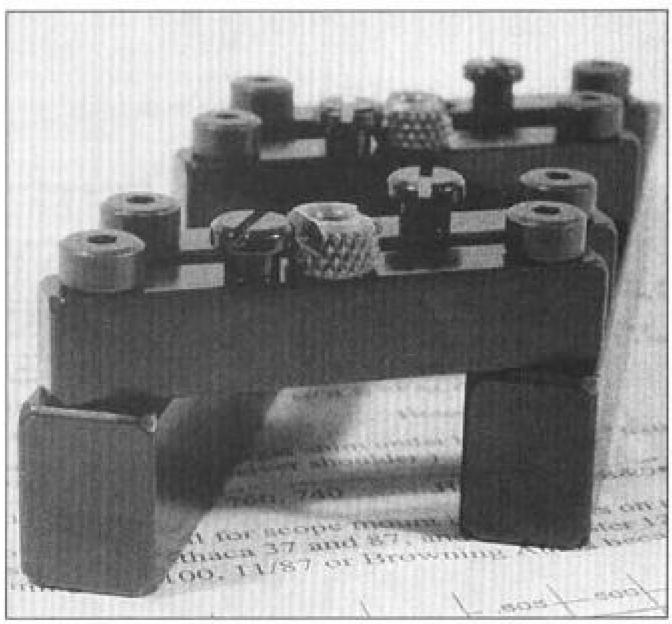
You can get saddle mounts from Aimteeh, B-Square and Millet. The installation method is the same. Make sure the shotgun is unloaded. Run the bolt forward and press the trigger disassembly pins out. Wipe the sides of the receiver clean and then wipe with a heavily-oiled patch. If you leave grit on the receiver, the clamped mount will grind the grit through your bluing. Wipe the insides of the mount clean. Slide the mount over the receiver and press the screws through. Tighten the mount screws snug but not as light as you can get them by hand. The screws compress the mount, and also the receiver. Be careful, the hollow shell of the receiver can be clamped lightly enough that the internals will not work.

Once the mount is in place, attach the rings and the scope, and head out to the range to sight it in.

The advantage of the saddle mounts is that they are temporary. Once the deer season is over, you can take them off and go back to using your shotgun with the beads and vented-rib barrel. What if you want a dedicated deer shotgun? The saddle mounts are not as rigid as a mount secured to the receiver. Each time you take the barrel off you have to sight the shotgun in again, a problem with a permanently attached mount. However, to clean

your shotgun you have to take the saddle mount off, a much larger headache for re-zeroing than simply removing the barrel.

The solution is to drill and tap your receiver and mount a base for a scope mount. Mounting the scope on the receiver is a viable enough solution that Mossberg shotguns come already drilled and lapped. To mount a scope on them all you have to do is order the right base, remove the plug screws and attach the base. For other shotguns, you have to do the hard work. First, select the base. The two types are Weaver style and Redfield style. The Weaver base is made of aluminum and angled on its sides, where the bottoms of the rings clamp around the bevels and stay in place. The Weaver is the lighter, bulkier and less expensive of the two. The Redfield is made of steel, and the front ring is a rotating dovetail. The front ring fits into the hole and then turns a quarter-turn to lock in place. The rear ring is held in place by two large-headed windage screws.



The Williams scope mount drilling fixture is basically a steel parallel ruler with drilling guides on the centers of the arms. The arms pivot to clamp the receiver and locate the holes.

If you open your Brownells catalog, you will not find a listing for shotguns other than Mossberg in the scope base selection charts. Which base to use? I settled on using bases for the Remington rifles. If 6–48 screws were enough (and for most applications it was) I used the base for a

Remington 740 or 742. If I felt the need for a larger screw, then the bases intended for the Remington 74 came with 8–40 screws. Given the curve of the top of the receiver, bases for the Winchester Model 88 and 100 would also work. None of these bases will match the top curve exactly, but they come plenty close enough.

This Remington has a Weaver base attached by drilling and tapping the receiver.

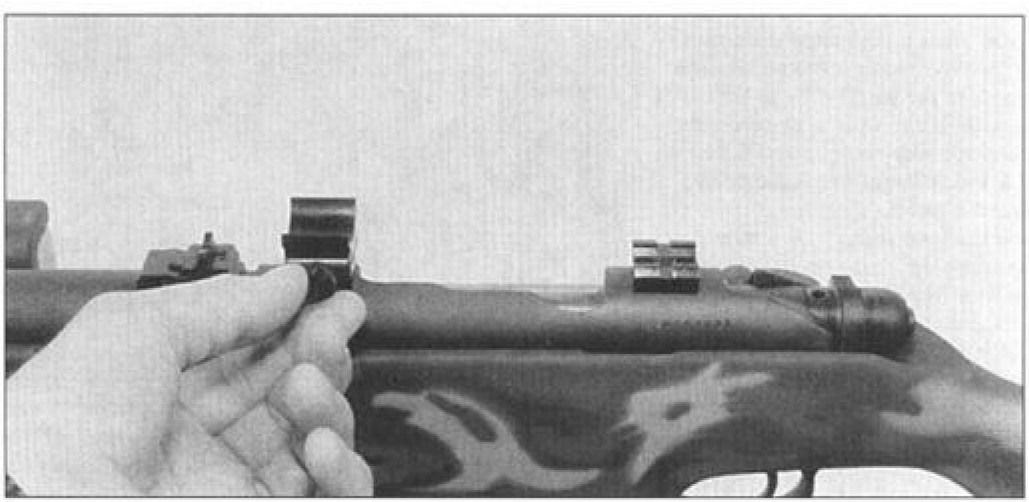
The only real difference in performance is one of appearance. The Weaver is a little bulkier, but not enough to be any problem. Pick the one that looks good to your eye. Whichever one you select, only get a one-piece base. Do not use a two-piece base. You will be using the base itself as a drilling gauge, and a two-piece base only makes the job more difficult. You will need the base, drill and tap for the base screws, (either a #31 drill and a 6–48 tap or a #28 drill and an 8–40 tap) your layout blue and dial calipers, a center punch and scribe, and later the rings and scope.

As in the installation of a ghost ring rear, make sure the shotgun is unloaded and disassemble it. Paint a stripe of layout blue down the center top of the receiver and strike your centerline in the blue with your dial calipers. Clamp the receiver in a padded vise. Place the base on top of the receiver. Slide it back as far as you can and still have the base on the flat part of the receiver. You do not want the back end of the base sticking out

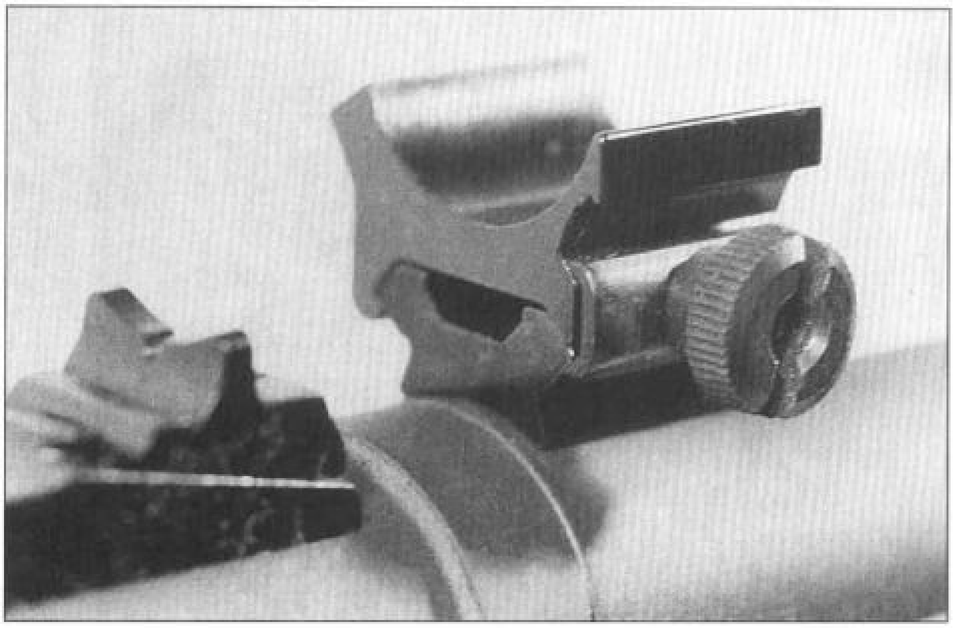
over the rear curve of the receiver. Use a piece of masking tape to temporarily hold the base in place, and remove it from the vise. Look inside the receiver and figure where the base holes will come through. If any of them will come through at or near the shoulder of the barrel recess, adjust the base location to miss the shoulder. Once your base location is set, use your scribe to mark the circumference of the front hole in the layout blue. Remove the base. Use your center punch to mark the center of the scribed hole on the center line of the receiver. Drill the hole and tap it. Take one screw and lightly clamp the base in place.

With the base held down, scribe the circumference of the rear hole over the centerline. Remove the base and center punch the drilling point of the rear hole. Drill and tap it. Repeat lightly clamping the base with the front and rear screws, and then mark the middle hole or holes. By using the base itself as your drilling guide, you needn't worry about drilling four holes in sequence, and then finding your arithmetic is off, or that the holes don't quite line up.

There is an easy way to avoid the worry and measuring. Williams Gun Sight makes a drilling fixture. The fixture consists of two parallel arms with the drill guides mounted on the pivot arms between the parallels. You need a large vise on your drill press, but the work is simple. Set the arms of the correct spacing for you base screws. Fit the fixture over the receiver so the hole locations will clear the barrel step inside the receiver. Clamp the receiver and fixture in your vise. Drill the holes.



The Mossberg M-695 comes drilled and tapped for scope mounts.



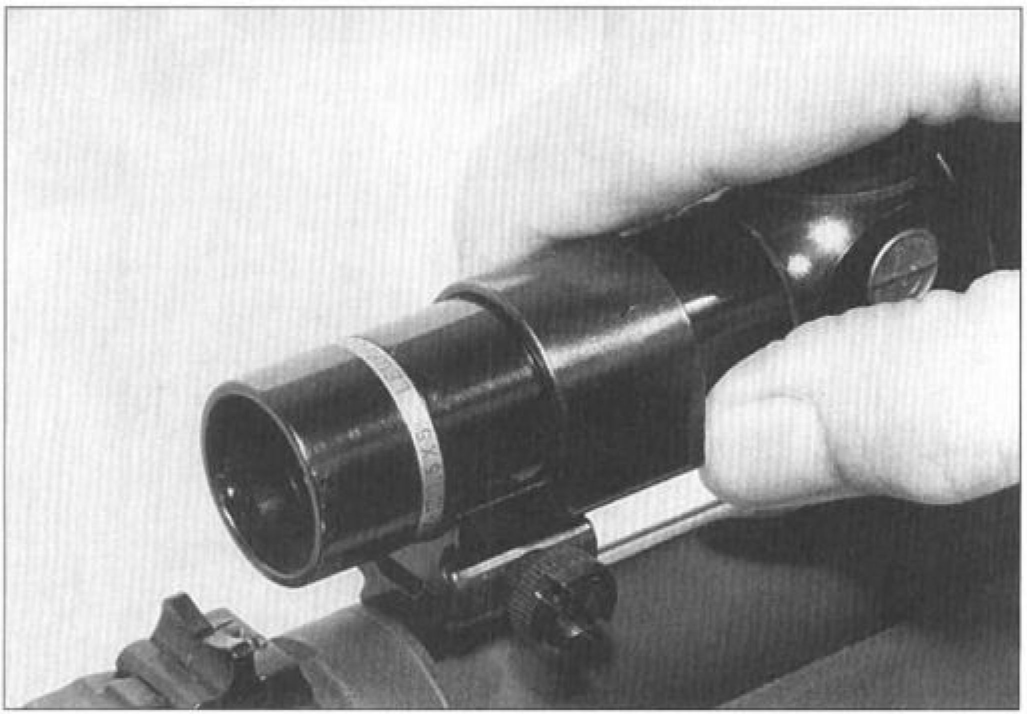
With the Weaver bases attached, the Weaver rings then go on. Unfortunately, the scope mounts block the iron sights.

An even more elegant solution (and more costly) is to use a mill as a precision drill press. Determine the location of the barrel step shoulder and mark it. Clamp the receiver in the mill vise and center it. Use the table adjustments to move the mill with a drill chuck installed, and drill the holes at the correct spacing for the base.

With the holes drilled and tapped, lay the base on the receiver, snug the screws in place and look at the base. Does it sit level? As with the ghost ring sight, the edges of the rolled or machined sighting groove may not be even, and you may have to lightly file the edge to get the base to sit level. Once you are satisfied with the fit of the base, turn the receiver over and look at the screws. In the front, where the holes are drilled through the receiver at the barrel extension, the screws will protrude into the receiver. Mark the screws and one at a time remove and shorten them until they are flush with the inside of the receiver. The job calls for a little patience, as the receiver wall at the barrel exension is not very thick. Once the screw is shortened enough to be flush you may only have a couple of threads of

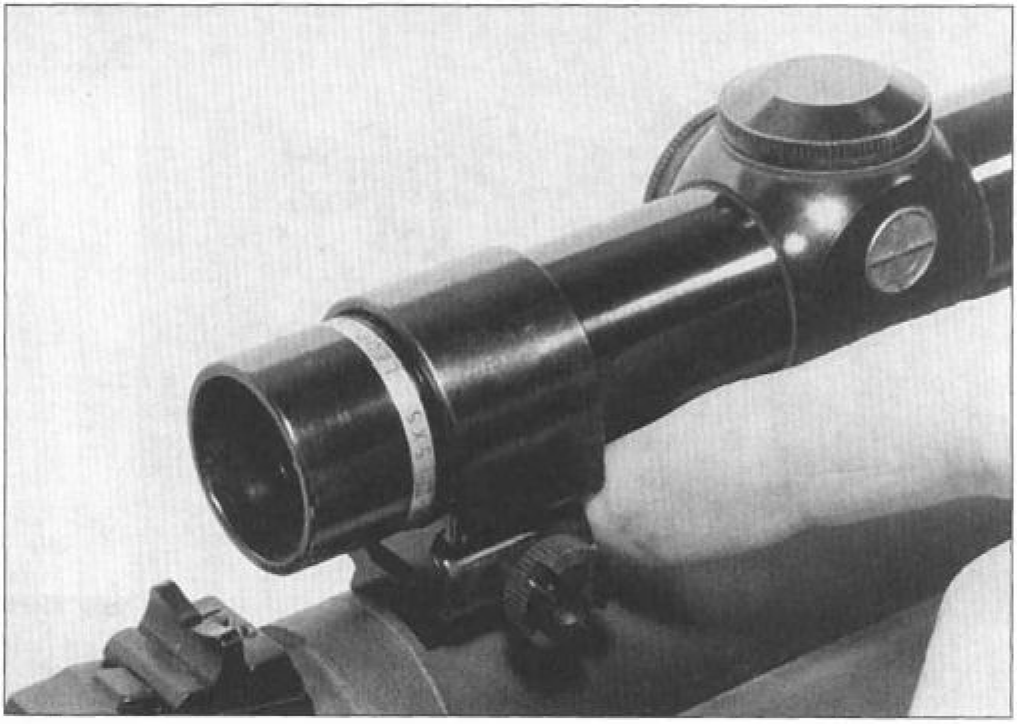
engagement. If you shorten the screw too much you may not have enough engagement to keep the screw in place. Once the screws have been shortened, take them out and keep them in order. The fitted screws will only fit properly in their correct holes. If you mix them up you may not have flush screws on reinstallation.

To secure the rings, slide the folded edge of the top under the lip on the ring bottom.

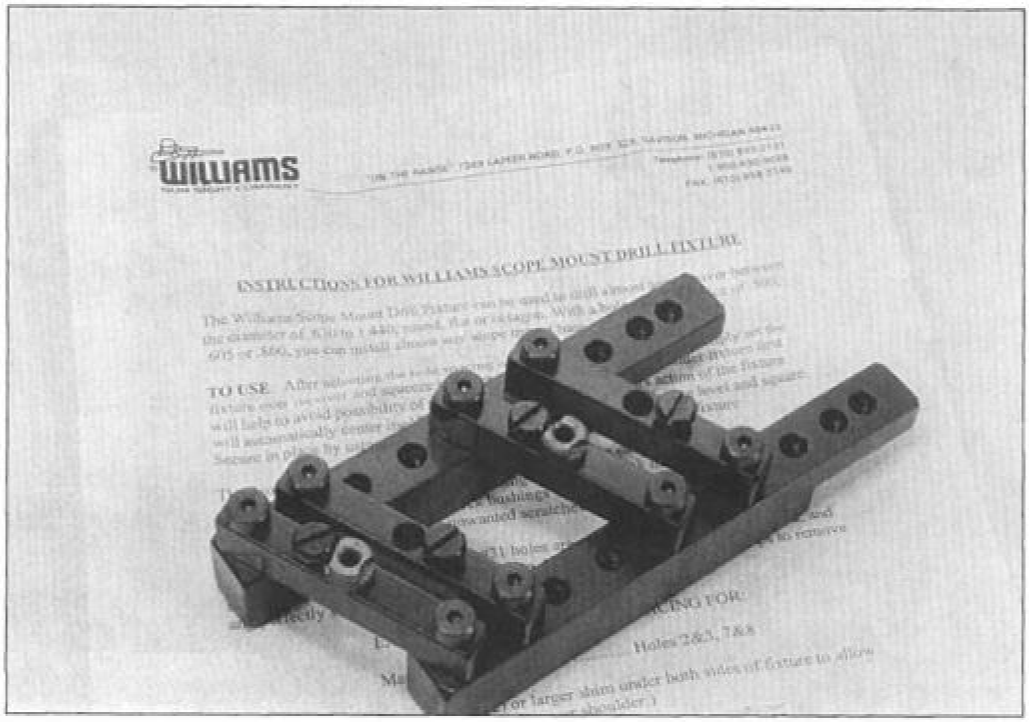


Degrease the receiver and the screws. Use a thread-locking compound to secure the screws in their appropriate holes. Some shooters are “belt and suspenders” kinds of guys. In particular, bowling pin shooters who will be using their slug guns on the BCBC course at Second Chance will mix a batch of epoxy and use the epoxy to secure their base instead of Loctite. They will test fire the shotgun before fixing the base that way, but once on they do not want any chance of it coming loose.

With the lip caught, install and tighten the rings on the other side.



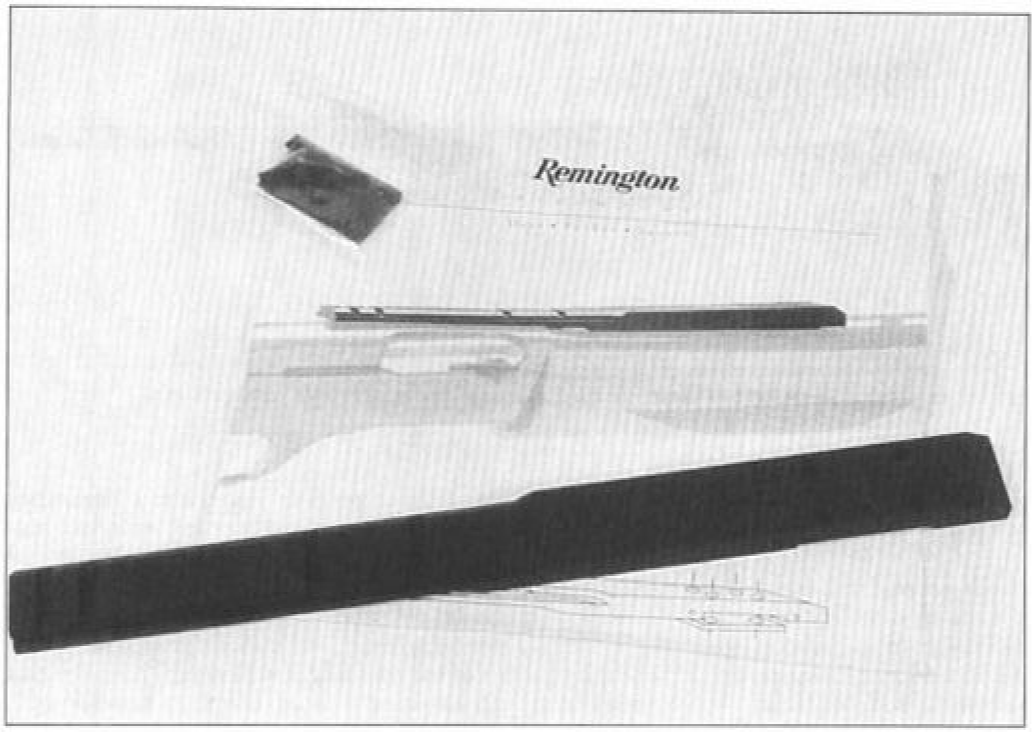
Ring selection on a shotgun usually calls for higher rings for a given scope than a rifle would call for. On a rifle, the barrel at the chamber can be markedly smaller in diameter than the front ring of the receiver. The barrel tapers quickly on many rifles. The front bell of the scope is out in front of the receiver, and can swell into the space vacated by the barrel. A shotgun barrel is not much smaller than the receiver it fits into. Even if it is, the shotgun receiver usually goes forward far enough that the scope bell is not past the front edge of the receiver. You must select rings tall enough to lift the scope bell off the top of the receiver. Once high enough, you may find the scope is too high for your stock, and a stock with a higher comb might be necessary.



The Williams drilling guide is a convenient way to drill holes for your scope mount or ghost ring rear. However, if you are only doing one shotgun, it can also be expensive.

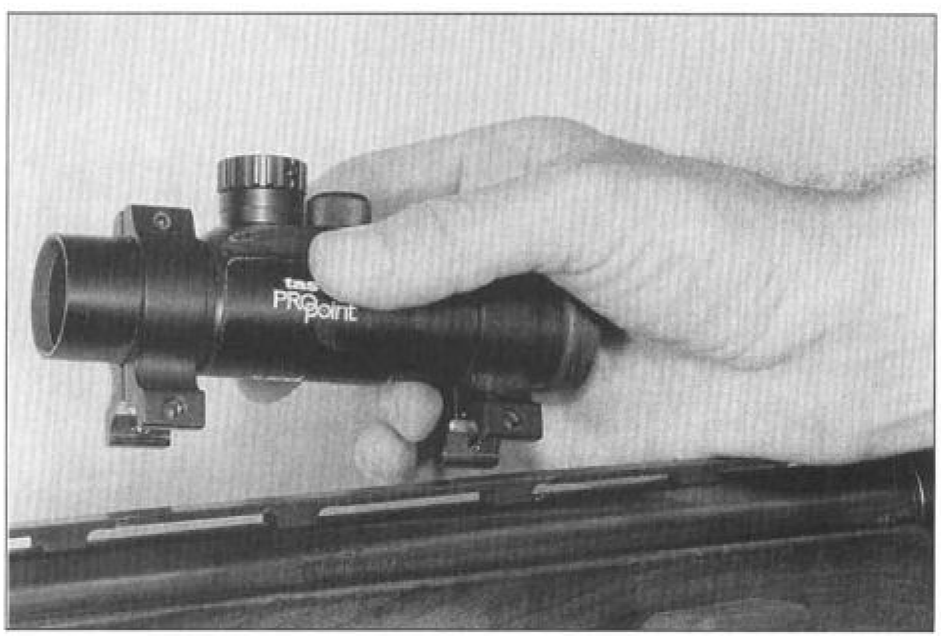
Barrel Mounts

The barrel movement of a shotgun can be a problem to accurate shooting. Not that the barrel itself isn't accurate, but with the barrel moving, and at least part of the sighting system attached to the receiver, lining the barrels point of impact up with the sights can be a sometimes thing. The only way to make sure the sights and barrel are always in perfect agreement is to attach the sighting system completely to the barrel. The rifle sights on a slug barrel do just that. It doesn't matter how the barrel moves around in the receiver, the sights move with it.



The Remington barrel adapter clamps right to the rib, and extends over the receiver.

Once set-up and adjusted, this red-dot sight can go on and off with only minor changes in its zero.



Until the recent past, mounting a scope on the barrel was not easy. Finding a scope that would work there was not easy. Every scope has an optical characteristic called eye relief. Eye relief is the distance your eye can be from the scope and still see a useful picture. Most scopes are meant to be viewed with your eye 3 or 4 inches away. A standard scope on the barrel would be more than a foot away, and useless as a sight. What you need is a medium or extended eye relief scope. And a place to put it. A medium eye relief scope (MER) is known as a “Scout scope” and is made by Leupold and Burris. Developed and championed by Jeff Cooper, the scout scope was originally intended for use on the Scout rifle, for fast and accurate sighting. It does the same for a shotgun. Extended eye relief scopes (EER) are made for use on handguns. They can be used on shotguns, but it can be difficult to get the correct distance from your eye. A shotgun with a barrel-mounted scope can take some getting used to, and not all shooters like the situation. If you do not mount the shotgun consistently you end up squirming around looking for the scope. An MER or EER scope works best and fastest when you shoot with both eyes open. While many shooters who are primarily shotgun shooters do shoot with both eyes open, many who started with rifles, or spend much time shooting rifles, do not. If you shoot an MER or EER scope shotgun with one eye closed, you lose the speed advantage.

With a scope attached to the barrel, removing the barrel to switch to bird hunting doesn't change your zero.

Current slug barrels meant for scope use have a scope base brazed to the barrel. The bases are of two types, pedestal and extended. The pedestal mounts require a scope with medium or extended eye relief. The extended

mounts, often called cantilever mounts, project back from the barrel, over the top of the receiver. With an extended mount you can use a regular eye relief scope. The extended mounts may look strange, but they offer a means of scoping a shotgun to those shooters who cannot get used to an MER or EER scope.

To mount a scope on a slug barrel that already has a mount is simple. You clamp the rings in place, set the scope in them and tighten the rings keeping the crosshairs vertical. Once secured, you go to the range and sight it in.

The mounting of a scope on a barrel not intended for it is a challenge, and one you need a rib to solve. The rib provides a place to secure your base. Without a rib, the job is a difficult one indeed. I have one plain barrel for a Remington 1100 that had a scope mounted to it before the scoped shotgun barrel became common. It was done by J. Michael Plaxco as a barrel for the BCBC at Second Chance. It looks like he started with a Redfieid base intended for a Thompson/Center Contender barrel, and milled a trough the length of the bottom surface with a ball-end cutter. The tricky part must have been soldering it to the barrel, as he soldered it directly over the barrel hanger. It works quite well, and Michael sold it because he was switching over to the Winchester Super X-1 as a competition gun. As a matter of fact, it works so well (or the SX-1 didn't) he said if that barrel ever went up for sale again, he wanted to be first in line.

Despite the success of soldering this base to this barrel. I cannot recommend it as a course of action. The soldering part is too tricky. If you do not heat the base and barrel enough, the scope will fly off under recoil. If you heat them too much, you may warp the barrel or loosen the barrel hanger. And you need a mill to modify the bottom of the base.

***This red-dot sight clamps right to the modified rib, once the rings have been modified*.**

An easier course and one that does not risk destroying a barrel is to drill and tap the rib (on a ribbed barrel, obviously) for a scope base. As with mounting a scope on the receiver you want a one-piece base. The flat rib calls for a flat base, and a base intended for the Marlin 336 works just fine. I have used Redfield and Weaver bases. You'll need a #31 drill. 6–48 tap, layout blue and a rib center finder and your drill press. Make sure the shotgun is unloaded and remove the barrel. Hold the base against the rib and move the base back and forth until you have a couple of screw holes over posts of the rib. If you are using a medium eye relief scope you want the rear lens of the scope at the front edge of the receiver. If you are using an extended eye relief scope you want the rear lens a few inches farther forward.

Mark the location of the front screw with a pencil. Clamp your barrel in a padded vise and use the rib center finder to mark the center of the rib for the front hole, right over a rib post. Use masking tape to protect the barrel and clamp the barrel in your drill press vise. You must drill a blind hole, one that does not go into the barrel. Place your drill press vise on the table so the drill comes down next to the rib. Lower the drill until the tip comes down almost to the exterior radius of the barrel wall. Adjust your drill stop so the drill does not go any deeper. By stopping just off the barrel wall, you

give yourself the maximum amount of threaded hole, while keeping the barrel wall intact. Drill the first hole and tap it. Deburr the edge. Place the base on the rib and snug the screw down. Use the rear hole of the base to locate your next hole. Scribe the hole and then remove the base. Use the rib center finder to locate and mark your next hole. Check drill depth to make sure you aren't drilling into the barrel. Drill and tap the hole. Repeat securing the base with the front and rear screws, and mark and drill and tap middle ones.

Once all the holes have been drilled and tapped, degrease the rib, base and screws and fasten the base using a thread-locking compound to secure them.

Once the base is on, mounting the scope is easy. Fasten the ring bottoms, and place the scope in them. Tighten the ring tops while making sure the scope stays vertical. Take it to the range and sight it in.

In the event you decide that you do not want to have a scope on your barrel any more, you can remove the screws and base and install plug screws to fill the holes.

Chapter 10
Bluing

You have to have something to protect your shotgun. Bare steel has this annoying tendency to rust. Except for stainless, which isn't really stainless but rather stain-resistant. Abuse your stainless firearm enough, and it will rust. But while all-stainless handguns have been accepted for 20 years now, and all-stainless rifles for 10, all-stainless shotguns are just beginning to become available.

Right now they are all carbon steel, and must be protected from rust. In the early days (right through the 19th century) shotguns led a hard life and finishes were not very good. As an example, while many Civil War muskets (originals) are highly-treasured for their "patina," the truth is they didn't look that way while in service. While early ones were carefully blued, in the middle of war production the bluing might be overlooked. Even if it had blue, once it got into the hands of the troops, they would end up bare. A common and popular "cleaning" agent was a slurry of campfire ashes and water, used to counteract the acids of the powder residue. Rifles were left bright. Only after time (decades of non-use after the war) would the steel oxidize into the brown color so treasured.

Rust is oxidized iron. Some metals oxidize to form an impenetrable barrier against further oxidation. Iron is not one of them. Steel can be formulated to rust into a tough skin that resists further rusting, but the alloys are not suitable for use in firearms. To protect the steel, we either deliberately put a layer of rust on it, or coat it with something that oxygen and water cannot penetrate.

The most common protective rusting is known as bluing.

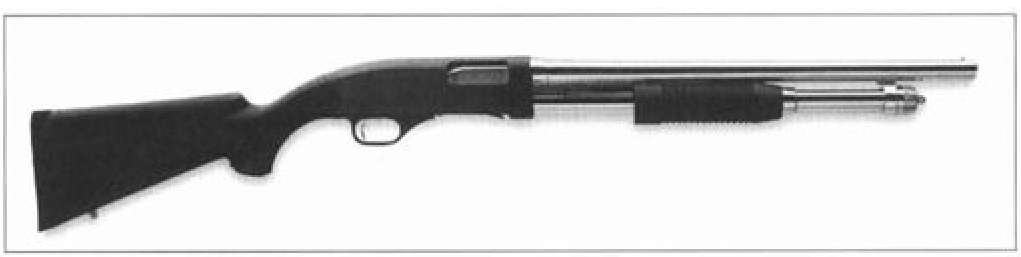
The application of most bluing, plating or protective coverings requires a substantial investment in equipment, regular use to maintain proficiency and, finally, space. You may not want to invest in a bluing system just to have your one shotgun re-blued, but you do want to know what is available, and what you can expect.

The idea is simple. By chemically reacting the steel on the surface, we tie up the potential ability of unwanted rust to form. In practice it is hard. The end result of any finish applied to metal is dependent entirely on the level of polishing done, and the attention to detail. A first-class protective finish,

with one exception, looks worse, much worse, with a bad polish job. The only finish that doesn't look worse is Parkerizing. More on polishing later.

While stainless is catching on, as with this Ruger, most shotguns are still made of carbon steel. It can rust if neglected.

Bluing is formed by using a caustic solution to cause the surface of the steel or iron to react and form an oxidized layer. As we use the term “bluing,” it can only be applied to steel or iron. Other metals won't react to the bluing solutions, and require their own chemicals for finishing. The two methods that are useful in covering complete shotguns are the hot-dip method using caustic salt solutions, and the rust-blue method.



Stainless steel is the other white metal, and one less prone to rust. However, you can make modern “stainless” rust, so still keep it clean and oiled. (photo courtesy U.S. Repeating Arms Co.)

In the hot-dip method, the parts are degreased and then immersed in a hot pickling solution of a mild acid to remove any surface oxidation. (The

irony, before you can oxidize the surface, you have to remove oxidation.) The pickling solution also removes any remnants of lead, plastic and powder residue that may be in the action or bore. Once clean, surface stripped and warmed, the parts are then immersed in the boiling salt solution. Proper bluing requires a bit of practice and knowledge of the steels involved. The operator may have to adjust the temperature of the bath, send the parts through two or three times, and keep an eye on the strength of the solution.

***Steel rusts. The protective finish known as "bluing" is merely protective rust. It is not perfect*.**

Once the parts reach their proper color, they are removed from the salt solution, washed clean, and then soaked in a bath of water-displacing oil. The oil creeps into every gap and forces the water out. The residual and expired salts sometimes will creep out from between parts days after the bluing was done. You can occasionally remove a shotgun new from its box, to find white crusty salt deposits on the edges of parts. The white stuff does no harm. Brush it off and apply a few drops of penetrating oil at the joint.

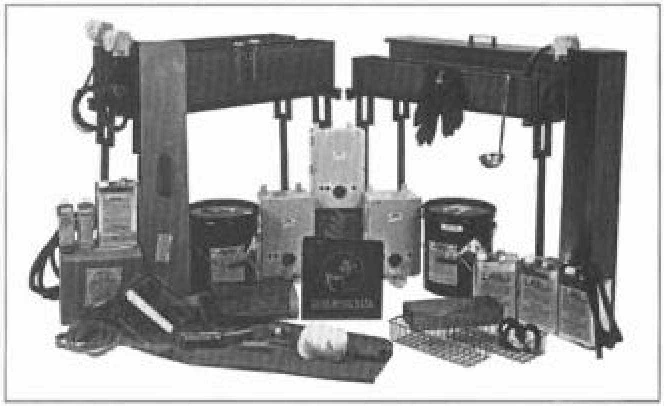
Hot-dip bluing is safe for springs, and covers all parts immersed in the tanks, including the bore. The hot-dip method will dissolve lead-based solder, aluminum, and brass beads. Anything plastic that goes into the tanks will be dissolved. Alloy steels or case-hardened steels may take on some

strange colors. I have seen iridescent greens and reds from some hardened receivers, and one that came out a horrible splotchy gray.

If you want to try hot-dip bluing, the Brownells First Step kit has everything you need, and won't break the bank. (photo courtesy Brownells)

The water-displacing oil is not meant as a lubricant or a protective oil during use. Once you get your shotgun back, be sure to oil it with a teflon-based lubricant against friction and protection from the elements.

The rust-blue method is the older method and preferred by some shooters. The hot-dip method produces a very dark blue, in some alloys it is black in color. The rust-blue method produces a finish more blue in color. The big reason for rust-blue is to protect older shotguns. In the U.S. many doubles, and all made since World War II have been fastened by high-temperature silver solder or brazing. The high-temperature solder is not the least bit bothered by the acid dip and caustic salt solution of hot-dip bluing. Many imported shotguns, British and Spanish, are fastened with soft solder. The rib and connecting plate, the end caps between the barrel, all are attached with lead-based solder. The acid dip and caustic salt solution dissolves the lead solder. If you hot-dip a soft-soldered barrel assembly, you are likely to end up fishing out the individual parts.



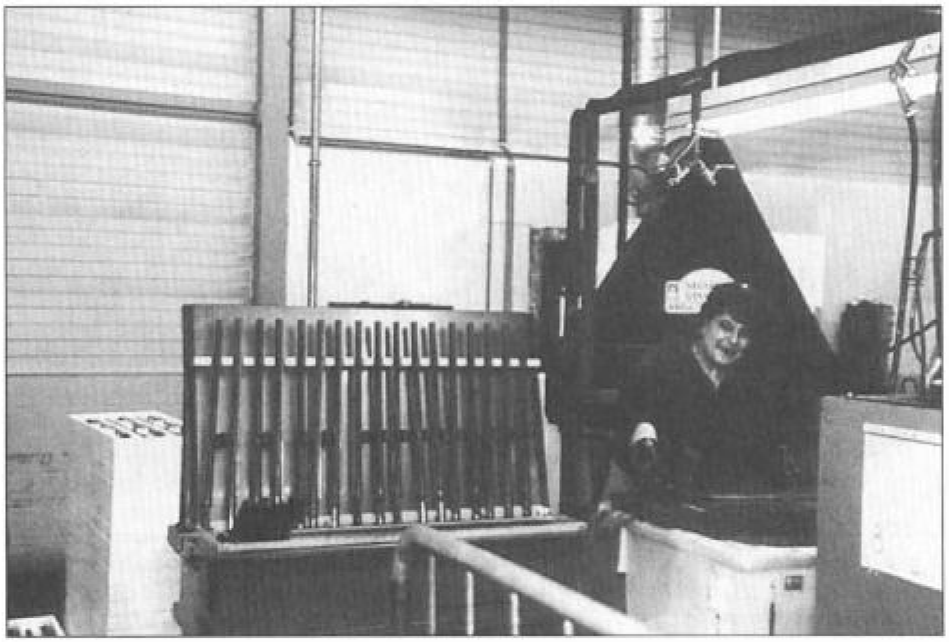
For those who don't want to mess around with gas, the Brownells electric setup provides bluing tanks powered by a wall socket. (photo courtesy Brownells)

Rust-bluing does not attack the solder. Rust-bluing takes more hand-labor, and tends to be more expensive than hot-dip bluing. Depending on the exact nature of the chemical solution used, the details of rust-bluing vary. In the basic outline of the rust-blue process, the polished parts are de-greased and then boiled in clean water. While still hot and wet but out of the tank, the rust blue solution is swabbed onto the parts. Take care not to cause runs or streaks, or rub the solution on. Simply swabbing to create a complete coverage is all that is needed. The bluing happens in the humidity cabinet. The parts are suspended in a cabinet that maintains a constant and high humidity. Left there for a day or more, the parts are then “carded.” The now-fuzzy parts have the crusty layer rubbed off with a brush, leaving the blued color on the steel. Too much carding can take the blue off, meaning more trips through the process. The boiling, swabbing and hanging is repeated. The more times the parts go through this process, the deeper the blue and the more durable the finish.

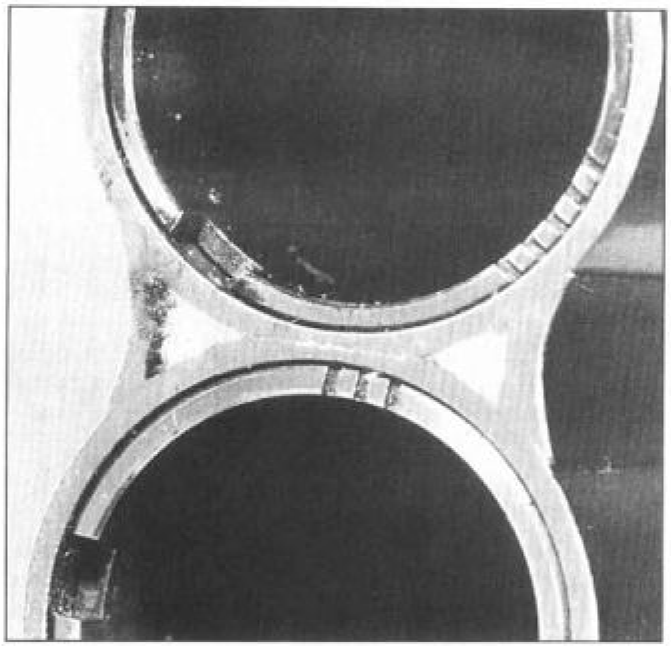
The Brownells full bluing system kit provides everything you need to get started on a career in bluing. Except the guns to practice on. (photo courtesy Brownells)

Rust-blue is not done to small parts unless you want the price to go up astronomically. Rust-blue also is not done to the bore. Properly carding the interior of the barrel would be impossible. Once finished, the rust-blue surface is protected from the elements by wiping it with a patch wet with a teflon-based lubricant. The lubricant protects the blue, the blue protects the steel. One big advantage to rust-blue is in touch-up. A hot-dip blued shotgun can only be re-blued by repeating the entire process. Disassembly, acid stripping, etc. A rust-blued gun can be touched up without doing the whole gun, and the repair will be as durable as the rest of the finish.

Here barrels are being cleaned after bluing at the Fabrique National plant in Liege Belgium.



Because hot-dip is done for shooters in a hurry, and the tanks can handle gun after gun for hours on end, hot-dip is the common and inexpensive bluing most shooters see. The rust blue method is usually applied by gunsmiths with delivery times of many months or even years, and who will not let something leave until it is perfect. (Not that hot-dippers don't strive for perfection, they do.) It is not unusual for a rust-blue job to cost two or three times as much as a hot-dip job. For a shotgun that can't stand the acid, the cost difference doesn't matter.



The bluing salts can ooze out for a while after the process is done. This can be easily cleaned off with steel wool and some oil.

To get around the problems of the hot-dip bluing, and speed up the rust-blue process, Brownells developed the Dicropan IM® process. It uses hot water, but the bluing salts do not dissolve lead-based solder. As fast as the hot-dip method, it is safe for soft-soldered doubles. It covers the parts entirely, and is safe for springs. It does require disassembly and stripping of the parts before immersion, just like the caustic hot-dip method.

Rust bluing is a labor-intensive process that is necessary with shotguns that have soft-soldered barrels or ribs.

The one-tank Dicropan IM kit provides you all you need for not much more than the cost of a bluing job by someone else. With a source for heat, it is the perfect way to start, practice or find out if bluing is for you. (photo courtesy Brownells)

Brownells Dicropan IM bluing is a hot water system that is safe to use on soft-soldered shotguns. Three tanks, chemicals and instructions. (photo courtesy Brownells)

Cold Blue

The solutions known as cold blue are all chemical depositions on the surface of the steel. They are not as durable as the hot-dip or rust-blue methods, and should only be used as touch-ups. If you have a scratch you want to hide, or a corner where the bluing is rubbed off, but don't want to go to the expense or hassle of a complete rebluing, then a cold blue solution is for you.

With the unloaded gun on the bench, use some 0000 steel wool to clean the area you are going to touch up. You want to remove any oil, wax or surface oxidation that may be on the area to be blued. Once clean, degrease the area. An aerosol cleaner can work, or some rubbing alcohol. Gently warm the area, holding it next to a light bulb. With a clean patch, dab some of the cold blue onto the bare steel. Let it sit for a few minutes, then rub with steel wool. Degrease and repeat. Once you have a suitable finish built up, rub with the steel wool and oil to stop the chemical process. The cold-blue will rub off easier than regular bluing will, so if you expose your shotgun to the same thing that rubbed it bright before, it will quickly rub bright again.

***Touch-up blue hides wear or scratches, but cannot be used to refinish a whole shotgun*.**

Browning is a rust-blue process that uses different chemicals 10 produce a brown instead of a blue finish. Browning is traditionally more correct on a muzzle-loading shotgun, while bluing is preferred on breechloaders. No particular reason, just owner preference.

Fire Blue

By heating a part to a known temperature and letting atmospheric oxygen attack it, steel can be turned a blue color. Many gunsmiths have learned the trick of re-bluing a small part that has been filed to fit, by using a propane torch to heat it until it turns “fire blue,”

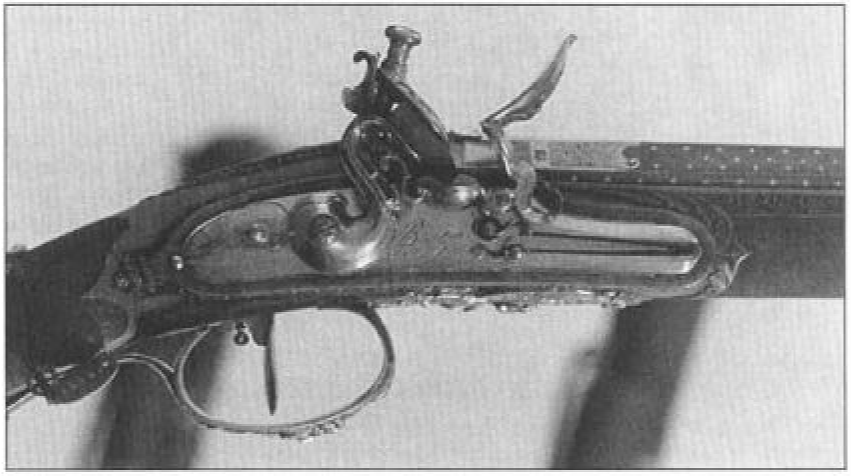
Colt (who made shotguns for a white in the 19th century) used to heal blue all of their handguns. The finished firearms were put on racks and degreased by dipping them into vats of boiling gasoline. (Again, could I make this up?) Once degreased, the racks were then put into soaking ovens and the racks would rotate while the ovens fired up to oxidizing temperature. Once the handguns were blued, they would be pulled from the ovens, cooled and oiled. The blue was and is beautiful, but not very protective.

Case hardening

The two methods of color case hardening are both difficult, and one is dangerous. The non-dangerous method involves packing the parts in carbon powder and bone meal and baking them in an industrial oven. Once heated to 1,400 degrees, the parts are quenched in dean, pure water. The colors are beautiful, but the quenching can warp parts. The less-involved but hazardous method involves cyanide solutions and a propane torch. Lest I encourage anyone to try it, I won't go into further detail. Let's just say it is only slightly less dangerous than juggling nitroglycerin, and the fact that generations of British gunmakers turned out color-case hardened actions and locks without dying from the process is a near-miracle.

The colors are beautiful, but the hardening is not very deep. And the surface is not very well protected against corrosion. A case-hardened part can be blued, but anyone who covers with bluing a British Best double receiver that was originally color case hardened should be ostracized by the rest of the members of their gun club.

Browning is a different chemical result than rust-bluing, but the same kind of process. This shotgun was browned in the 18th century, and is still in fine shape.



Parkerizing

The basic Parkerizing process for firearms is simple. The clean parts are suspended in a boiling solution of phosphoric acid, a solution that has iron, manganese or zinc dissolved in it. The phosphorus reacts with the steel to form a tough and durable surface, quite resistant to corrosion. A Parkerized part that is kept oiled will resist rust very well. What it won't do is look elegant. Parkerizing (originally the name for a particular process, now the name of the method in general) started out as a protective surface for military firearms. It has seen wider use in the last 10 or 20 years, for its lower cost. The acids attacking the surface roughen it, and hide many tool marks. The parts do not have to be polished, simply machined to final dimension and then sent to the boiling acid. For a hunter who wants a durable finish, or a hunter who will be using his gun hard, and wants it to hold up, Parkerizing offers many benefits. But it can't be called pretty.

One option the military developed is Parkerizing. It is a tough and durable phosphorous precipitate. It is also dull and some say, ugly.

The color of Parkenzing depends on the dyes used in the final steps of the process. It can be anywhere from a light gray, to a green to dark gray or black.

French Gray

Nothing shows off engraving like bare steel. With a little ink rubbed into the engraving to show it off, and some frosted highlights, engraving can practically jump off the gun. I'm sure the original French Gray was just bare steel, as the aristocratic owners didn't give a hang about cost or maintenance. They wanted looks and performance. The steel was frosted or grayed by bathing or wiping the receiver in strong acid solutions. Later, clear lacquers probably covered the steel for protection, but none of the traditional methods offer any protection at all. And its not like you can buff the rust off, after all, there is that pesky engraving.…

Newer methods offer more or much more protection. One way to get the gray color is to caustic blue the parts (generally only the receiver is treated to be grayed, so hot-dip blue isn't a problem.) and then use a diluted acid solution to “fade” the blue into gray.

While slightly more durable than the original “finish” it still doesn't offer much protection.

A better solution, if you simply have to have a gray receiver, is to have the receiver plated, and then have the plating bead-blasted to produce the

soft gray finish color and texture. If you want to go this route, electroless nickel is probably better than hard chrome. The e-nickel does a better job of getting into holes, and won't build up on edges and corners as hard chrome can.

Protective platings

The closest many shotgun shooters used to get to plating was the occasional Italian shotgun with chrome-plated bores. Protective platings are quite popular on handguns, where many shops specialize in various chromes, nickels, and teflon-based finishes. The platings have not caught on with shotgun shooters to the same degree, probably because shotgun shooters seem to be more conservative. However, with the increasing numbers of hunters who expect their shotguns to perform under extreme conditions, platings are becoming more popular. And the handgun competitors who try shotgun shooting do not seem to be bound by tradition, and will try anything that has a chance at working.

French gray or bare steel kas always been popular, as it shows off engraving like nothing else. With a few gold inlays, it really is an eye-catcher.

This competitor has elected to ease his maintenance burden by having his shotgun plated with hard chrome.

Traditional nickel plating is shiny and not very useful. However, done right it did and does offer more protection than bluing does. When it was the only option, it made sense to nickel plate. Now, with high-tech platings that offer superlative protection, nickel should only be considered a cosmetic choice. Proper nickel lplating requires an intermediate base such as copper, and nickel placing adds an appreciable thickness. It cannot be applied to closely-fitted working parts without causing binding.

Hard Chrome

Also known as industrial hard chrome, the application and results are entirely different from “bumper chrome,” Where nickel has depth to its appearance, and adds thickness, hard chrome is so thin it simply makes the parts appear a stark white. Much harder than the base metal, hard chrome was originally developed to plate cutting tools in industrial applications. Early in the usel of hard chrome, a situation known as hydrogen embrittlement caused problems. Anyone who is in business today and plating parts knows how to deal with it, and you only need to ask how long a company has been plating firearms. Brittle guns caused by bad plating

will show up right away, and a poor plater can't stay in business very long. If they've been at it more than a few years, you can count on the plating being done right.

Nickel

The regular nickel-plating uses an electrochemical deposition to plate. The e-nickel is a chemical reaction that precipitates and bonds the nickel to the steel. The lack of an electrical charge prevents the tendency of regular nickel plating to build up on comers, and also its failure to go into holes. The electro-less nickel solution adheres to and plates all of the steel it reaches, inside holes and complex surfaces. Electroless nickel is not as hard as hard chrome, but has a very firm bond to the underlying steel. An e-nickel part properly plated can be bent 180 degrees without the e-nickel breaking. There is even a government test, MIL-C-26074A to test the bond. Electroless nickel is a slightly yellow or golden color.

Teflon

By adding Teflon to the electroless nickel solution, beads of Teflon can be trapped in the very thin layer of e-nickel, improving lubricity. One solution developed by The Robar Companies, and called NP3, is a silver-gray to dark gray finish, and shows the texture of the surface through the finish.

The Armoloy process is a nodular thin dense chrome application. It can be applied to steel, stainless or aluminum, but not all at once. You must have the three separated to treat them. It is very hard, as hard as hard chrome, and a dark gray color. The Armoloy company is a plating company without a gunsmith on the premises, so if you send your shotgun to be plated, it must be completely disassembled. Armoloy should not be applied to springs.

Gold

Gold plating offers no protection, and indicates little taste. Gold inlays, on the other hand, indicate good taste. They don't offer any protection. Ditto with silver.

Aluminum

Aluminum can't be blued by any method we have discussed so far. Aluminum also cannot be plated by any electrochemical method, but it can be treated by the electroless nickel method. The aluminum e-nickel

chemical baths are formulated differently than the steel baths, and you cannot mix steel parts in aluminum chemistry or vice versa. An aluminum part to be e-nickel plated must have all steel parts removed before plating, just as with the Armoloy process.

Anodizing is a chemical treatment of the aluminum that hardens the surface. The anodizing does not add color. The color is a result of the dye used at the end of the process. Clear-coat anodizing leaves the aluminum its natural color, with whatever surface texture it went into the tanks with. Most aluminum is anodized black. If you search out your local anodizing company, and they are willing to treat your firearm, be prepared for a stiff cost. Anodizers treat large batches of parts for their customers. Each customer provides the specifications of the aluminum alloy of which their parts are made. Your part is unknown, and rather than risk contaminating the parts of a regular industrial customer, the anodizer will run your part by itself. You'll pay the costs of a run in its entirety. It may cost $100 to have your Mossberg receiver re-anodized. If for that money you want it to be a nice Teal color, tell the anodizer and he'll see what dyes he has on hand.

Sprayed-on finishes

Not everyone needs or wants a fine, deep blue or a flashy plating job. Turkey hunters, duck and goose hunters and even deer hunters have all taken to camouflage. In many parts of the country, game is increasingly wary. Here in Michigan the deer seem to have a newsletter that they publish, and the date of opening day is well known. They may be quarry, but they aren't stupid. Hiding both the hunter and the gun becomes important when the game is wary.

At the minimum, a pattern of aerosol paint sprayed onto a hunting gun can go a long way to hiding your presence.

Better yet are the baked-on finishes from Brownells. You can even mix and match the colors to come up with your own camouflage pattern.

Detail strip the shotgun. Clean it thoroughly, as any dirt or gunk left on it will interfere with the finish adhering to the surface. Clean any rust off' with steel wool. If you do not, the rust will continue to work under the finish, and you'll find the finish bubbling off.

Prepare the oven. Clean it and wipe it free of any cleaning residue. If it is a self-cleaning oven, run the cleaning cycle and when cool wipe the ash out. Make sure your parts will fit. Some ovens will not be large enough to hold

longer barrels, mine only holds banels up to 24 inches long. If you are not using a bake-on finish, the oven size doesn't matter.

With the parts scrubbed, lay them out on a large sheet of paper. You will find it easier to determine coverage and the colors if you do the spraying in bright sunlight. The paint will dry to the touch faster, too. Determine what you want your finish to end up as. Do you want a dark finish with light highlights or flecks? Stan with the light colors. Do you want a light finish with dark colored flecks, then start with the dark. Spray on an even coat of the base color. Let it dry enough that it isn't sticky. Sprinkle some leaves or straw over the paint, and with them in place, spray the next color. When it dries, repeat with the next color.

Once dry to the touch, remove the leaves or straw and inspect the pattern. Too dark? Spray the light color far enough over the parts that you are only misting the paint on. If you find large dark patches, a light and angled spray with the light paint will lighten the color. Use the same process but reverse the colors if the overall pattern is too dark.

One big advantage to sprayed-on finishes is the opportunity to practice and adjust until the job is just right.

Which finish for you?

For a practical shotgun competition shooters, the only thing to do is have the whole gun hard chromed or electro-less nickel plated. For a duck or goose hunter, such a plating job would offer a high degree of protection. For the goose hunter out in the snow, the shotgun wouldn't even have to be camouflaged!

For the traditional-minded shotgunner, the choices are between hot-dip blue and rust-blue. Someone with a double whose receiver is originally color case hardened may want to have the receiver re-colored rather than simply blued.

A worn Mossberg 500 can have the steel parts hot-dip blued, and the receiver anodized.

Where to find a refinisher

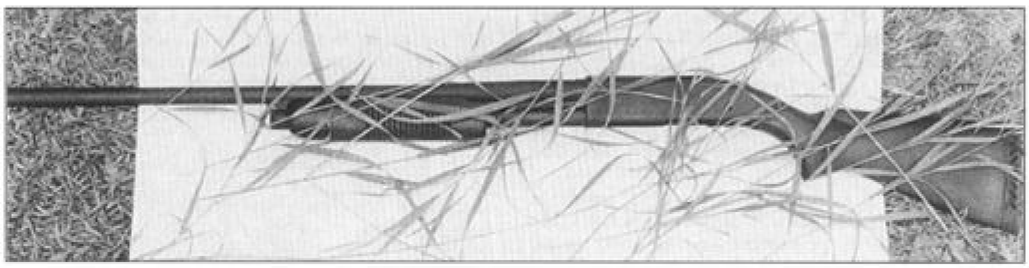
The first thing you want to ask yourself is, do you want to do bluing yourself? The short answer is no. When I was sending my work out to be re-blued I ended up going through seven different bluers over the years, as each one seemed to get sick and retire or the on me. It must have had

something to do with bluing in the basement. Bluing for the hot-dip method takes chemicals, tanks, ventilation, and a dedicated place to do it. You can't do bluing in a corner of the rec room, and you can't do it without ventilation. The chemicals will have to be healed up to between 270 to 285 degrees. You will need a bare room with a concrete floor and nothing in the room that can be harmed by the vapors. The drips from the chemicals will ruin anything but a concrete floor, and stain even that. Without proper ventilation you will get sick. All that said, there are many gunsmiths and bluers who have managed to stay healthy despite years of working around the solutions. If you want to blue, you have to emulate them. Think only of working in a clean space, with proper ventilation, and don't do anything in a hurry.

The bare shotgun is obvious to your quarry. Nature does not make straight lines, so the barrel is a big tip-off.

To find someone to do bluing for you, ask around at your gun club. Find a couple of shooters who have had good experiences. Ask to see a sample or two of the work they had done. Before you go see the bluer decide on what level of polish you want done, and what your shotgun can take. Many bluers will always do a high-polish re-bluing job unless told otherwise. It takes skill to polish correctly, and who doesn't want to show off? If possible, ask to see what other polish levels he (or she) offers. I kept a set of cut-off barrels on the bench that I had my bluer polish to three different levels. My customers could look at a sample of the polishing level, and decide for themselves what they wanted.

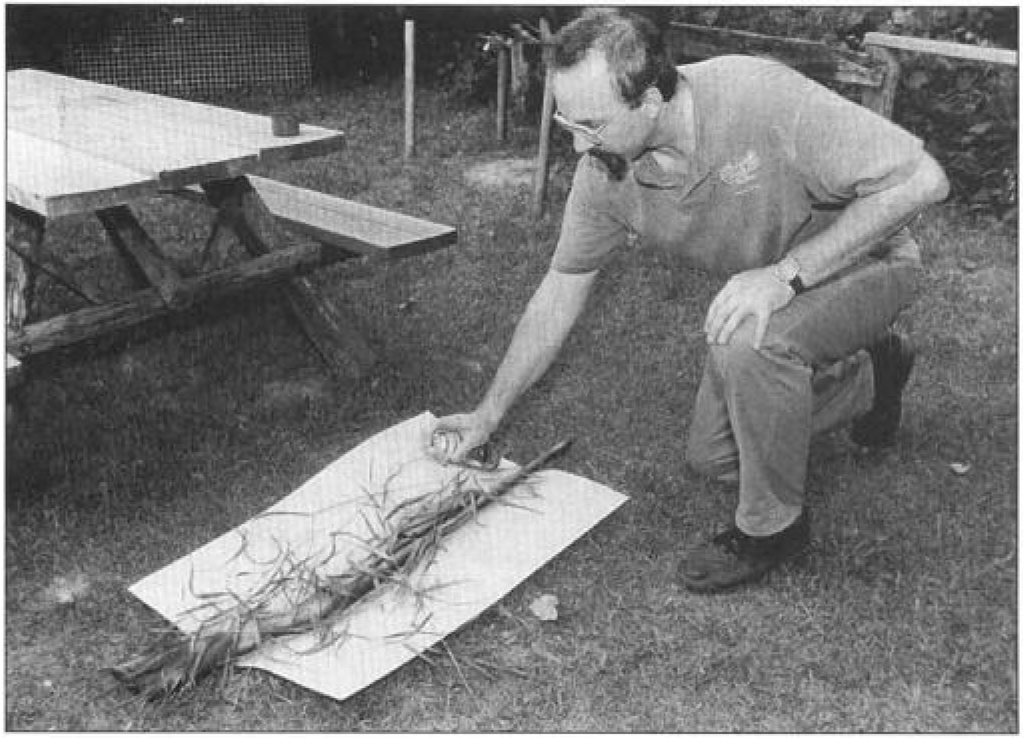
The first thing to do is give it a coat of flat black to even out the finish and provide a base.



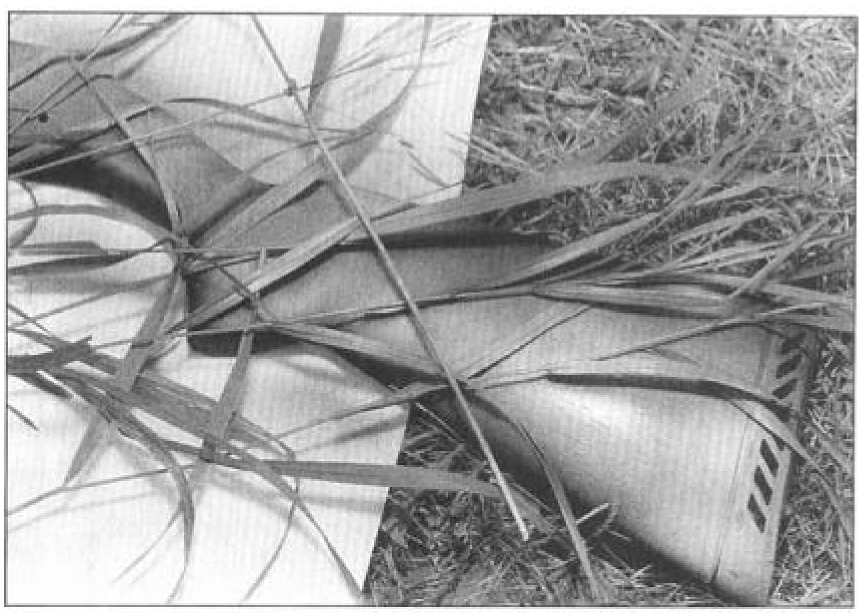
Then, spread some leave or grass over the shotgun. The paper is just to show the grass, and provide a backdrop for the painting.

Not every shotgun can be buffed to a gleaming finish. If the poor thing has been exposed to the elements too much on hunting trips, and there are pits, you may have to settle for a bead-blast finish. The pits, if left unpolished, would show up like lab rats at a wedding. But if you have the pits buffed out, the surface could end up dished, and look messy.

Spray the paint or bake-on finish, alternating colors and adding more grass.



If you want your shotgun plated, search out the practical shooting competitors at your club. They can tell you who, if anyone in your area, does hard chrome and electroless nickel.



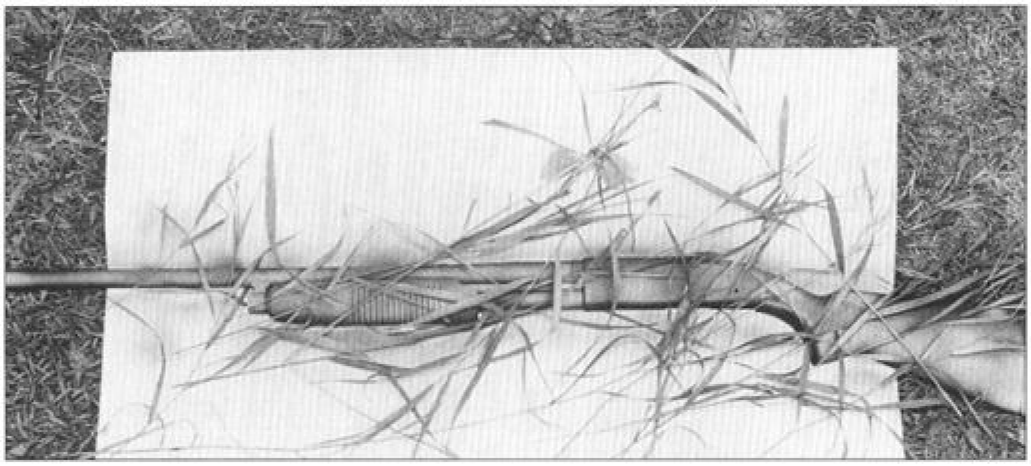
***Match the general paint scheme to your conditions. Light colored hunting backdrops call for more tan, while dark swamps call for more dark green and brown*.**

The secret to a good finish is the polish. Fresh chemicals and the correct temperature can do nothing about an ugly scratch except blue it. While bluing does hide some blemishes (which is why a lot of engraving is left “in the white”, to show it oft) there is only so much it can do.

While the chemicals and tanks needed to blue are not for the home gunsmith, you can do the polishing yourself. Talk to the prospective bluers in your area and see if they will take jobs that have already been polished. Some will not. Others will dunk anything you bring to them. Some, like Bob Cogan of Accurate Plating and Weaponry in Florida, accept pre-polished firearms, but reserve the right to touch-up the polishing if needed. “Hard chrome especially, shows any blemish. Rather than have a customer walking around with an ‘oops’, well look it over and make it perfect,” he said. If you are going to take or send your pre-polished shotgun off for a re-finishing, and the bluer says he will touch-up if needed, explain your work. What polish level are you going for? What finish will it get? If there is a blemish you've over-looked, the bluer can make sure his correction blends with what you've done and what you intend.

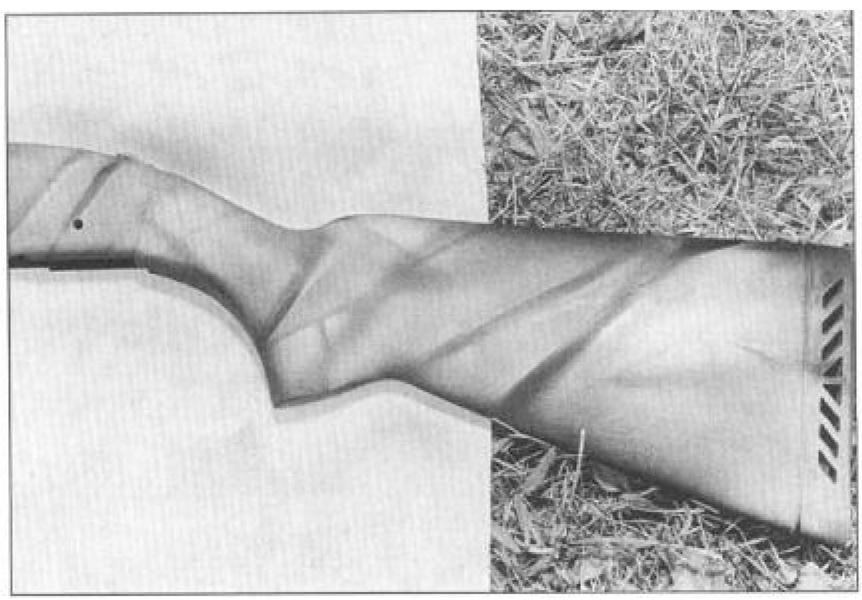
As with stock work, the secret to polishing is a flat backing. If you are going to polish your shotgun prior to taking it to the bluer (the bulk of the cost is the labor of polishing) then you have to polish your shotgun with abrasive cloth backed by a sanding block, and a lubricant. There is no secret but patience. Start with a grit close to or at the level of polish you want as your final polish level. For instance, if you want to have a gleaming high polish, and will be using 600 grit as your last paper, don't start with 220. You'll spend most of your time polishing up the 220 and intermediate grits. Unless you need the 220 to remove some bad pitting, go right to the 600. On the other hand, if you are polishing to remove pits prior to having a shotgun Parkerized, there is no need to use anything but the 220.

The sanding block prevents you from sanding dishes and waves into the surface of your steel. Even on a curved surface like the barrel, use a backing block.



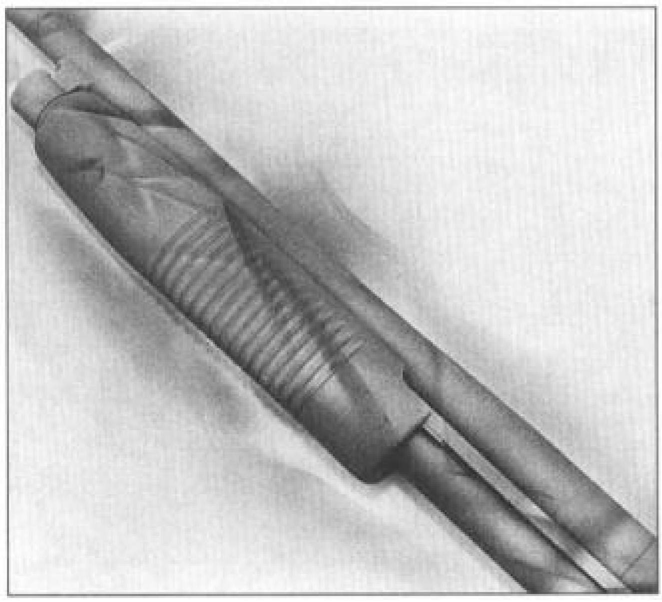
Here's how the shotgun looks with one coat of tan over the grass.

You can see the effect of one color over black.



You use an oil when sanding to extend the life of the paper, to make the polishing go a little easier, and to protect the fresh surface of the steel. If you stop part of the way through the job (it will probably take several evenings of polishing to cover a shotgun) wipe the abrasive slurry off and wipe the steel with an oiled cloth to keep the protective layer on.

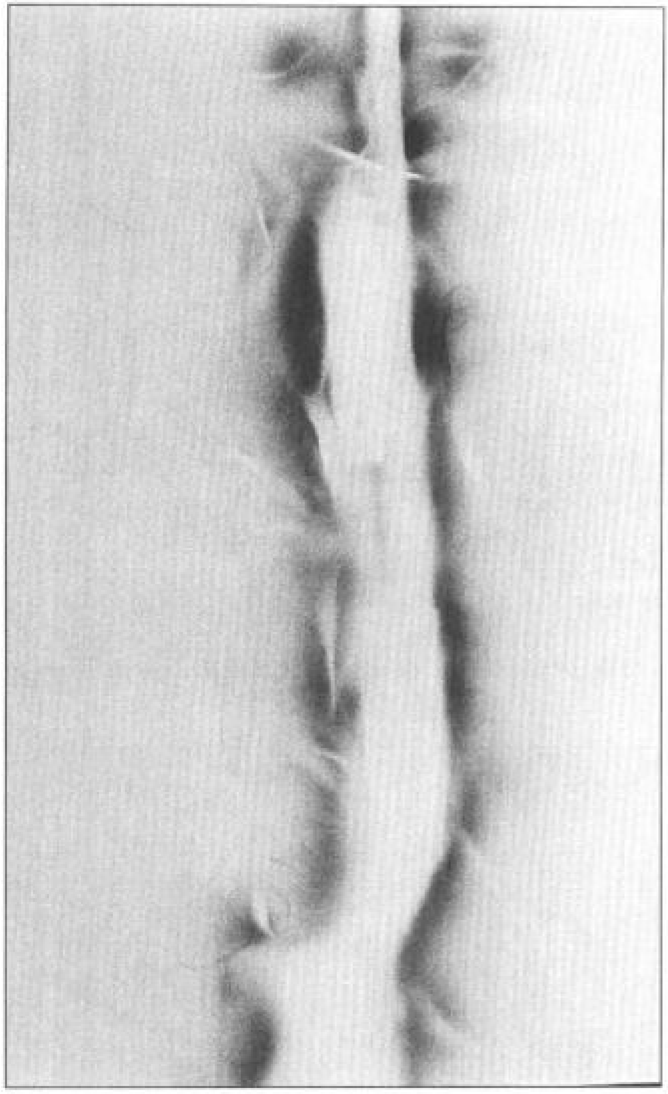
Once polished, it's time to send it off. First, inventory the parts. Write a list of what and how many parts you are presenting for bluing. The list can be as simple as “one Savage/Stevens 311 12-gauge complete without wood.” Or you can be more detailed. More detail is better. If you want to, you can stamp the serial number of your shotgun on the major parts to be sure they stay together.



Adding more colors and shifting or adding grass blends the colors more.

***The finished product, blended for the light greens of a Michigan spring*.**

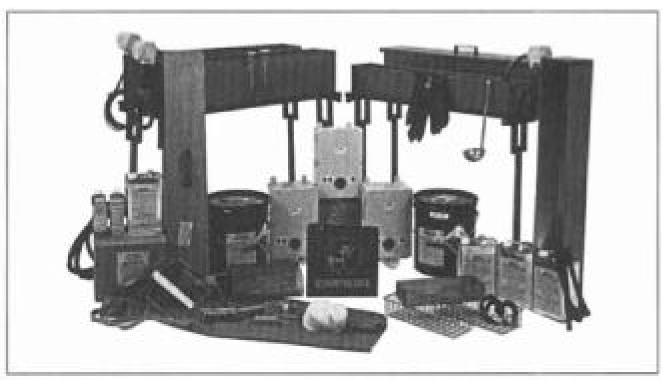
A bluer's shop can be a busy place. There will be many disassembled firearms, in boxes, trays and baskets. By providing a list, you give the bluers an extra method of ensuring that everything you sent, comes back to you. “It never fails.” said Bob Cogan. “At least once a week we get a gun where the owner forgot to include some part or another. With an inventory list and a phone number we can call and have them send it.”



As you can see from the outline, it doesn't take much paint. A set of four cans can do a bunch of guns.

if you want to try hot-dip bluing, the Brownells First Step kit has everything you need, and won't break the bank. (photo courtesy Brownells)

If you are going to have the bluer do the polishing, you definitely want to look at some of his work before you turn your shotgun over to him. Many bluers and platers are hardworking and conscientious and will do everything they can to keep your gun looking good. Others are simply buffing wheel hacks who will turn your shotgun into a gleaming mess of rounded corners, dished screwholes and washed-out lettering.



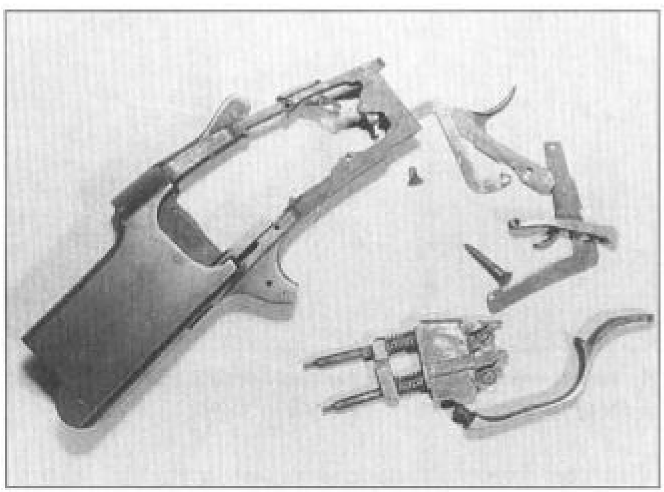
For those who don't want to mess around with gas, the Brownells electric setup provides bluing tanks powered by a wall socket. (photo courtesy Brownells)

If you don't need the durability of the Brownells bake-on finish, then spray paint from the hardware store will do.

When you look at an example of polishing, look at the corners, screws and letters. A polishing wheel is a soft wheel of cloth that is impregnated with a polishing media. If the person doing the polishing is not careful, the soft cloth will lap over the edges of a corner, and erode the line of the corner. The cloth will squirm down into a screw hole, and when it is pulled up on the other side it will wear the edge of the screw hole. Lettering is not always deep, and a heavy-handed polisher can wipe the lettering off, or smear it. The smeared lettering is the same effect as the dished screw hole, with the addition of the temporarily distorted edge of the wheel differentially polishing the area downstroke of the letters.

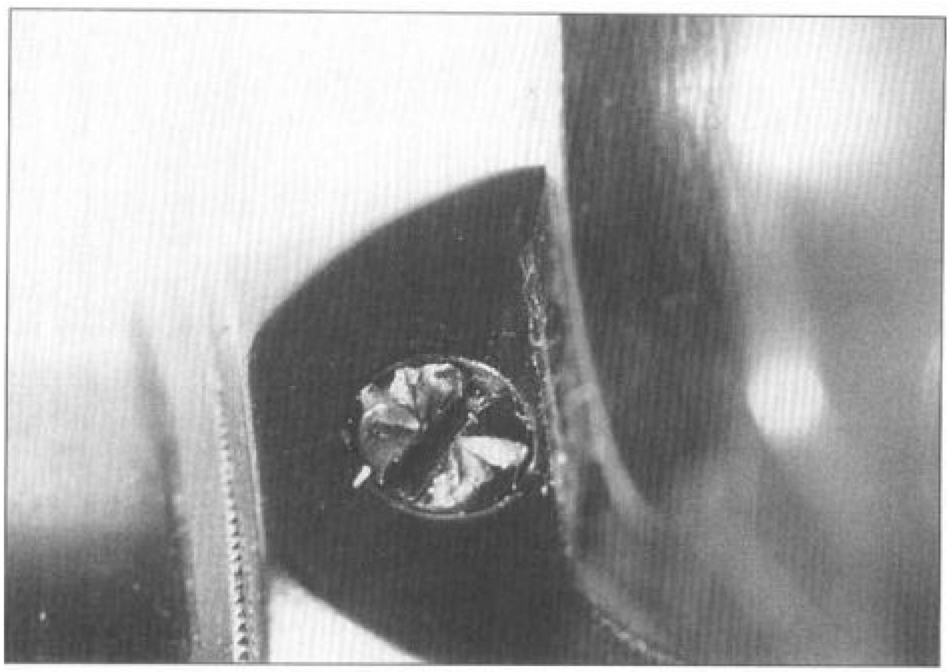
The Brownells full bluing system kit provides everything you need to get started on a career in bluing. Except the guns to practice on. (photo courtesy Brownells)

These light pits might be buffed out, but unless the bluer is careful, the polished area might show dishing or ripples.



If you do send a disassembled shotgun for bluing, be sure you have all the parts, and provide a list.

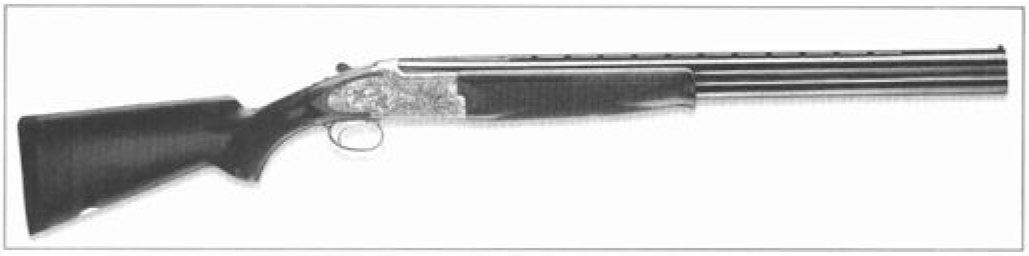
Polishing a shotgun is a fine art, and many are made less valuable by heavy-handed polishing. If it is an heirloom, leave the polishing to the pros.



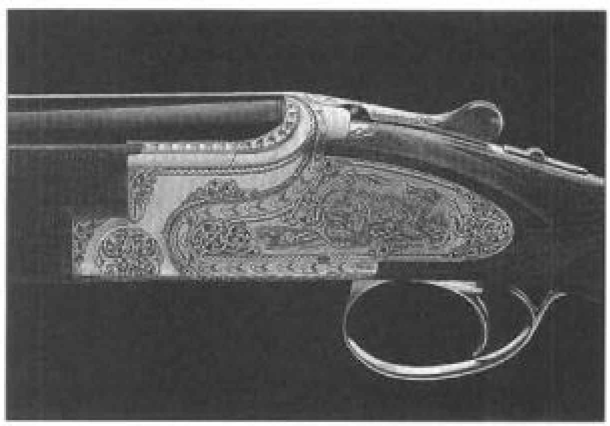
if you are going to have your shotgun re-blued, replace any damaged screws. There is no point in putting a new blue job onto a knarfed screw like this one.

If you look at a polishing job that has all these hallmarks, politely excuse yourself and look elsewhere for your bluing. While the matter of polishing level and brightness is a matter of individual taste, heavy-handed

“polishing” that shows such disregard for the lines of a shotgun is not bad taste, but bad craftsmanship.



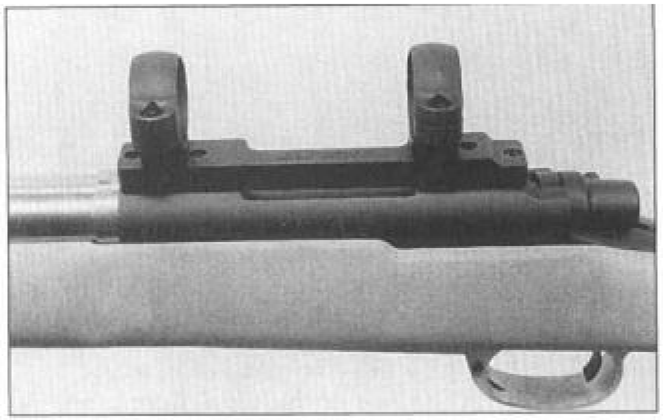
A shotgun like this Citori Privilege must be completely polished and the exterior finish done, before any engraving can be cut. Otherwise, the polishing would smear the engraving. (photo courtesy the Browning Arms Co.)



***This Browning B25 Grade FI is the modern pinnacle of a hardworking but embellished firearm that used to be the option only of the landed gentry or nobility*.**

Look before you leap, and make sure the bluers skills are up to your expectations before you send your shotgun off.

CHAPTER 11
Trigger Work



Rifle shooters can be disappointed by the feel of shotgun triggers.

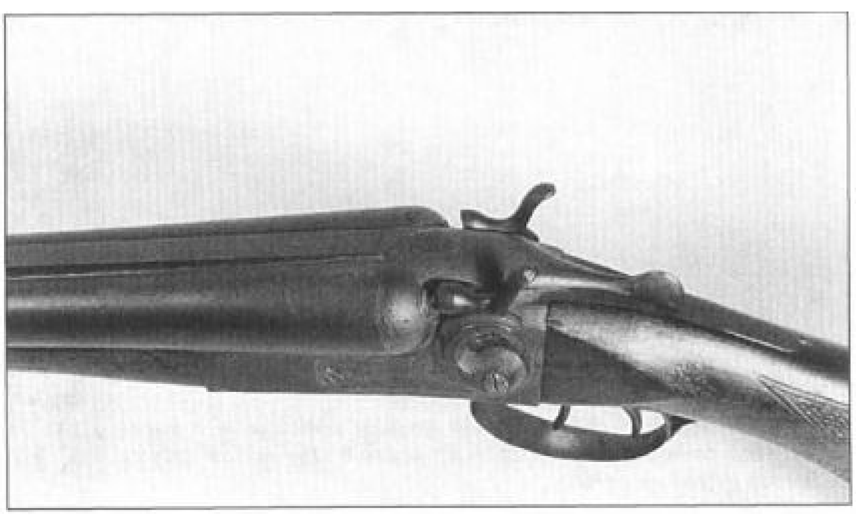
The first thing many experienced rifle shooters notice about a shotgun is that the trigger is different. In a word, it sucks. Accustomed to the trigger pull of a rifle, with a smooth takeup of the slack, a positive stop, a light pull and a clean break with little or no overtravel, the shotgun trigger can come as a shock. Shotgun triggers can be heavy and gritty, with a crunchy takeup and lots of overtravel. And yet, an experienced shotgunner can shoot well and never notice the trigger. Why?

In shotgun shooting the trigger pull hardly matters, and the swing is everything. If you are smoothly and consistently swinging through the bird you will be hitting it. Remember that you are launching a cloud of shot. A rifle shooter who squirms enough or slaps the trigger a little and moves his bullet's point of impact an inch at 100 yards is unhappy. In a shotgun you are working with a pattern that more than covers a 30-inch circle at 40 yards. Slapping the trigger and moving the pattern 3 or 4 inches at 40 yards still leaves the bird in the inner ring of the pattern.

Indeed, rifle shooters can do worse with a good trigger on a shotgun. A clean, crisp rifle-like trigger seems to bring out their rifle-shooting reflexes, and they start aiming instead of swinging.

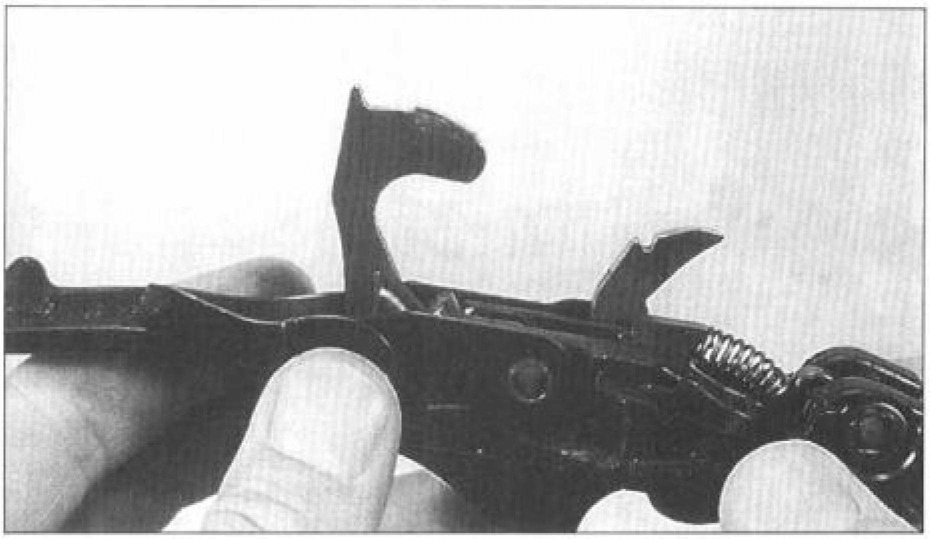
Shotguns don't have to have poor triggers. It isn't a law or anything. Most of them today have decent triggers. Older shotguns are the ones with poor triggers. I suspect the improvement in trigger pull comes from the relentless emphasis on trigger pull in the minds and expectations of rifle shooters. Since the shotgun makers can make the triggers decent, and many shooters expect it, shotgun triggers have, over the years, improved. Just don't expect your bird shooting to improve solely as a result of a better trigger pull. What can improve is your slug shooting and your turkey groups. However, improving the trigger on a shotgun can be difficult. Compared to rifles and handguns, shotguns pose huge obstacles to the beginning gunsmith. On many rifles, the trigger mechanisms have built-in adjustment screws. On some rifles like the Remington 700 these screws are sealed under plastic and not meant for adjustment by the end-user. But they are there and can be used. Many other rifles have adjustment screws that are not sealed away, and easily tuned. I cannot recall a single shotgun with adjustment screws on the trigger mechanism.

Shotguns don't have to have poor triggers. Back when shotguns had external hammers, the triggers were often quite good. After all, the hammer was the safety, and you didn't cock the hammer until you were ready to fire.



On handguns, you have half the work done for you and the parts are very similar from one model to the next. As an example, on a Smith & Wesson revolver, the single-action trigger pull is always so good you do not have to work on it, and need only to stone to improve the double-action pull.

Because they are so compact, handgun trigger mechanism are similar enough that adjusting a fixture like the Powers Stoning Guide allows you to stone any hammer or sear. By setting the fixture up for a particular model handgun sear or hammer, you can easily stone the engagement surfaces clean. Handgun shooters are very particular about their triggers. Hitting something with a handgun is hard enough without the trigger causing extra problems.



Having the sear hook on the top of the hammer makes it easy to fabricate, assemble and tune at the factory. It makes it difficult to improve the trigger pull by the usual gun-smithing methods.

Shotguns are not so easy. The wide variety of designs make constructing a universal fixture difficult. To see the design diversity, you only need to examine a Mossberg and a Remington hammer. On the Mossberg the sear notch is on the bottom. On the Remington the sear notch is on the top of the hammer. It would take quite some stoning fixture to work on both of those. And shotgunners have traditionally been insensitive to poor trigger pulls, and unlikely to approach gunsmiths for a solution. Faced with large design differences and a customer base not perceiving a problem, gunsmiths have not spent much time on the shotgun trigger problem.

On some models of shotgun any efforts at trigger improvement should be left to a professional. When the repeating shotgun came into fully realized form at the end of the 19th century, the designers did a curious thing. They

left out (or didn't bother putting in) a disconnector. When you pump the action, the hammer is re-cocked by the bolt or slide of the action bars. The disconnector is a part that acts in between the hammer or sear and the trigger. When you pump the action on a shotgun with a disconnector, the trigger or sear linkage to the hammer is interrupted. As you pump rearwards, the hammer is cocked, and the sear falls or is pushed back into the path of the hammer by the disconnector. When you pump forward, the hammer is caught by the sear and stays cocked. With the action closed, you must release the trigger and then press it again in order to fire.

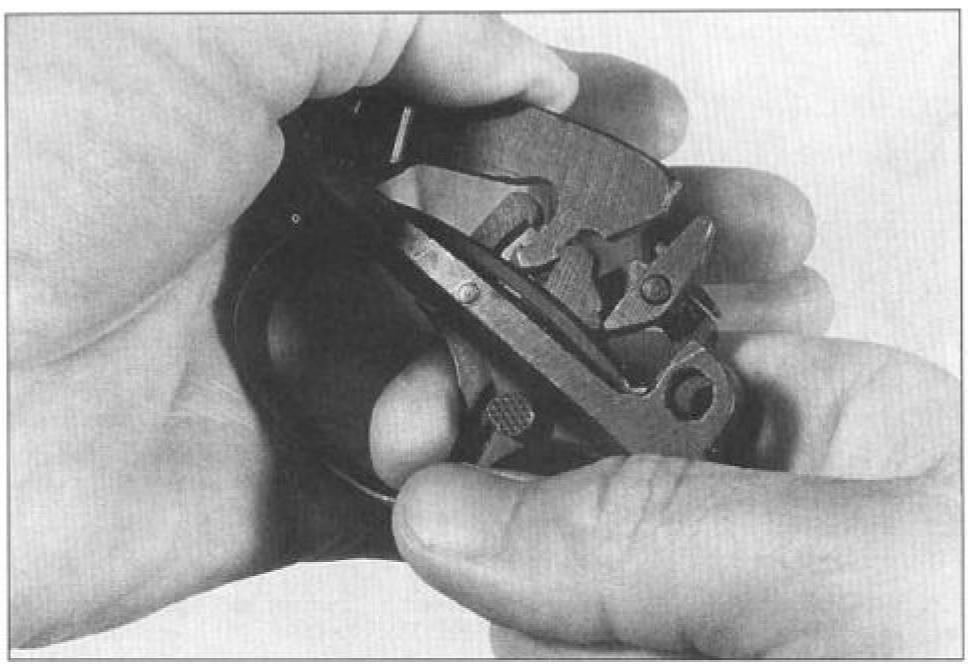
On a shotgun lacking a disconnector, there is no part to reset the sear into the path of the hammer. If your trigger is still holding the trigger back when your forward pumping closes the action, it will tire again. If you hold the trigger down, you can rapidly empty a pump shotgun by working the action and firing it each time it closes. The uninitiated assume this is a fast way to put a lot of lead downrange. They are right, but they fail to notice that it is also a fast way to do a lot of missing. The best way to use a non-disconnector shotgun is by learning to get your trigger linger in sync with the pumping, and get it off the trigger before the action closes.

The three most common pumps without disconnectors are the Winchester Models 1897, 1912, and the Ithaca Model 37. The Winchesters are understandable, as they are among the first pumps designed and manufactured in volume. The Ithaca is a curious one. Originally designed and made as the Remington Model 1917, it was made only in 20-gauge and had a disconnector! When Remington dropped it to concentrate on other models, the 17 was picked up by the Ithaca Company and sized up to 12-gauge. Somewhere along the way the disconnector “fell out.” Current production Ithaca shotguns are still lacking a disconnector, but the geometry of the bolt has been changed. If you do not get your finger off the trigger, the hammer will follow the bolt down. It will not strike the firing pin hard enough to set off the primer. If you are worried that you can close the action and have the hammer follow, and not be able to fire the shot, it is easy to check. When the hammer follows the bolt down, the action will be unlocked. If you can work the action without using the release tab, the hammer followed. If the action is locked tight, the hammer is cocked.

It is not a good idea to try to stone the sear of a shotgun lacking a disconnector. Without a disconnector to consistently set the sear into the hammer notch, you are depending on your trigger finger releasing the

trigger into the hammer's path. If you stone the notch and reduce the engagement, you run the risk of turning your shotgun from a non-disconnector shotgun into an “always disconnected” one.

So what can you do to improve the trigger on your shotgun? Depending on what model you have and what you want to do, there are a couple of choices. The first choice works for all, and that is to clean and lubricate your trigger mechanism. In addition to the cleaning solvents, brushes, a heat gun or blow dryer and lubricants, you will need a bottle of Trigger Job from Chip McCormick. Disassemble the mechanism or pull the trigger assembly from the receiver. Many shotguns go years without a thorough cleaning, and scrubbing the dirt, grit, powder residue and god-knows-what out of the mechanism can have an amazing effect. Then, take the Trigger Job and apply a small amount of it directly to the sear and hammer hooks. The lubricant grease will smooth and lighten the feel of the trigger pull.



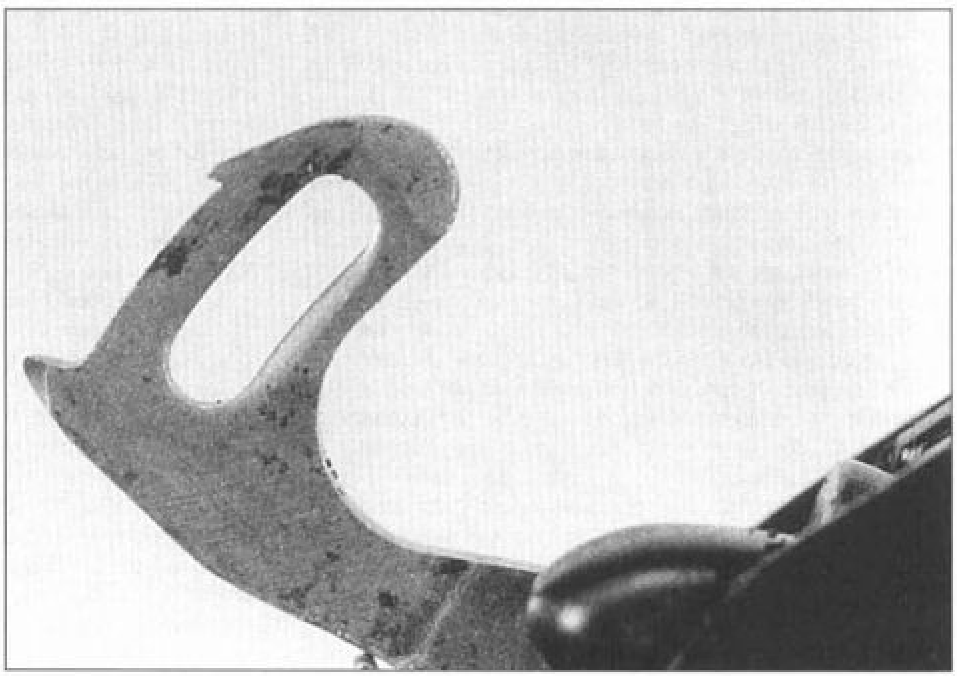
The Browning double-hook trigger mechanism can be tuned just like its rifle cousins. For slug shooting you might want to, but for bird hunting, the trigger is just fine right out of the box.

In the case of a new shotgun, you can always ship it back to the factory with a letter of complaint. If it is truly bad, you may get some relief. If it is

only somewhat bad and within test specs, it may come back just as you sent it.

Remington owners have another option. Hastings makes a re-built trigger mechanism that is already tuned for the best trigger pull. If you are going to use a shotgun as if it were a rifle, as in slug shooting or turkey hunting, you may want a rifle trigger. The clean and light break of the Hastings unit can be a great help. The beauty of the Remington design is that you can switch the trigger assembly from one shotgun to another of the same model.

Not only is the sear hook on this Remington (as on all) on top of the hammer, but the angle of the hook is into the hammer. If you try to stone the hook and "relax" the angle, you could end up with a shotgun that won't stay cocked.



CHAPTER 12
The Winchester 1897

There were other pump shotguns before the Winchester Model 1897. Partly because of the manufacturing and marketing success of Winchester, and partly because of the design genius of John Moses Browning, the '97 was the exemplar of a pump shotgun for decades. With the acceptance of the '97, other manufacturers could find a ready market for their models. The '97 was and is a light, handy, reliable firearm, and a shotgun so sturdily made that even a century later many examples are still going strong. When the American Expeditionary Force arrived in France in 1917 it didn't take long to figure out that a bolt-action rifle was not the best too! for trench raiding and night patrols. In the close quarters of the trenches, an entrenching tool with one side sharpened was a valuable fighting tool. The army had Winchester build the “Trench Gun.” A short-barreled '97 with a heat shield and bayonet mount, along with the Winchester M-12 Trench Gun it proved so devastatingly useful in the trenches that the Germans lodged a protest against its use. (This, from the inventors of chemical artillery barrages.) The War Department made it clear that any German reprisals against doughboys over the issue of shotguns as weapons would be met with equal punishment against German prisoners of war.

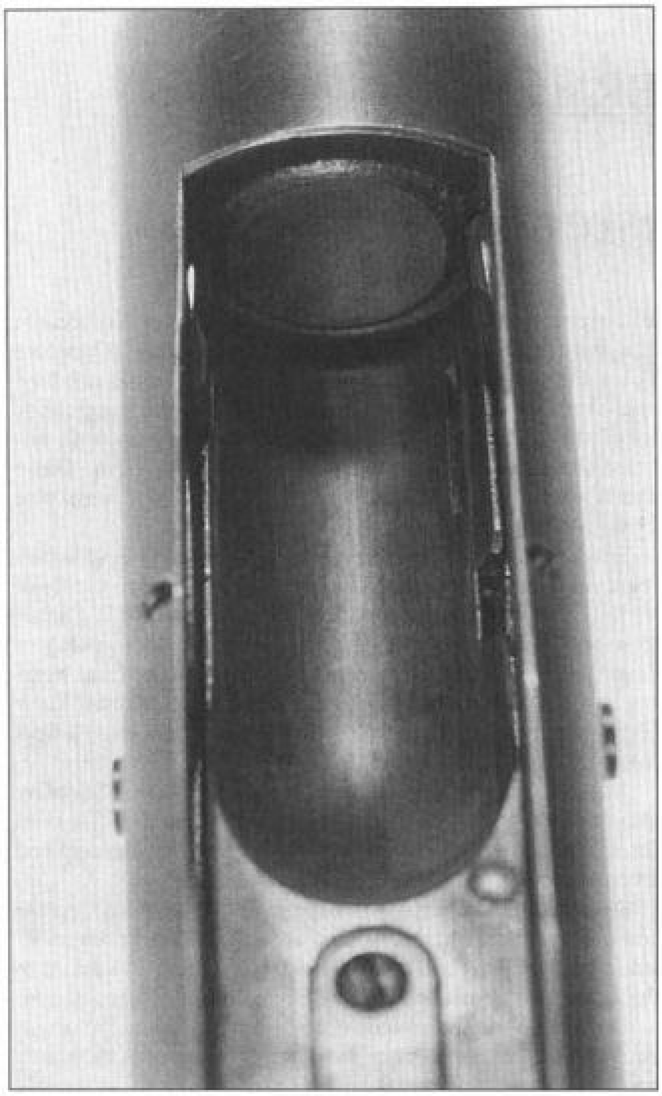
The '97 suffered from trench exposure as did every other firearm, and with a previously unseen problem. Even the then-new Parkerizing was only able to slow down rust, not prevent it. The mud got into everything, and a doughboy who didn't strip and clean his '97 would soon suffer the consequences. And the paper of the shells would swell in the moisture and loose its strength. A swollen shell would not chamber, or would hesitate in feeding. While the brass-cased rifle cartridges could get dirty, the dirt could be wiped off. A tarnished rifle cartridge would still work fine. But shotgun shells required gentler treatment. It became standard procedure to feed shells through the '97 before going out on patrol, and rejecting those that would not feed and chamber easily. Despite the problems, the doughboys loved the '97. And the War Department came up with all-brass shells to deal with the swollen paper problem. These shells that would be standard for combat use until the invention of plastic hulls.

Hunters loved the '97. For the cost of a quality double barreled shotgun a hunter could buy an 1897 and a large supply of shells. Law enforcement loved the '97. A lone sheriff in a small town was at a handicap facing two or three drunk cowpokes or desperadoes, holding only a double-barreled shotgun and wearing a pistol. Holding an 1897, he and everyone involved knew he had plenty of leverage with which to decisively settle a fight in his favor.

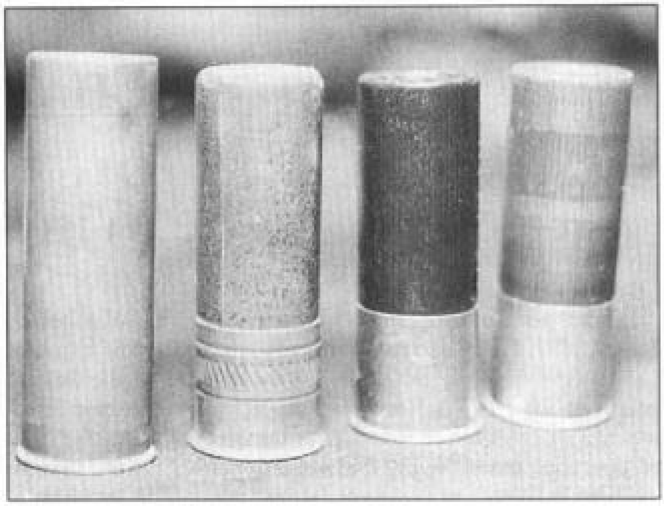
Modern shooters who compete in Cowboy Action Shooting also are fond of the '97. Again, it costs less than a double does (or will until all the Cowboy Action shooters buy them up and create a shortage), it is durable, and easy to use.

And those in the know still depend on it for defense. At the commercial shop where I worked we kept a Winchester M-97 strategically placed and ready for action. We had all taken it to the range at one time or another to make sure it worked and hit to the sights. With five rounds of buckshot or slugs in the magazine, and the chamber empty, it was ready to go on a moment's notice. I did not have to make many modifications to get it ready for defense. I installed a large brass bead at the muzzle of the 18-and-a-fraction-inch barrel, and a rubber recoil pad on the butt. (I can't remember if I lengthened the forcing cone or not. I probably did) Even in Detroit, the deterrent effect of a pump shotgun still works.

Here is the Model '97 action open. The carrier both lifts the shells and locks the bolt closed.



In the upright and locked position, the carrier is also the feed guide to reload the magazine.

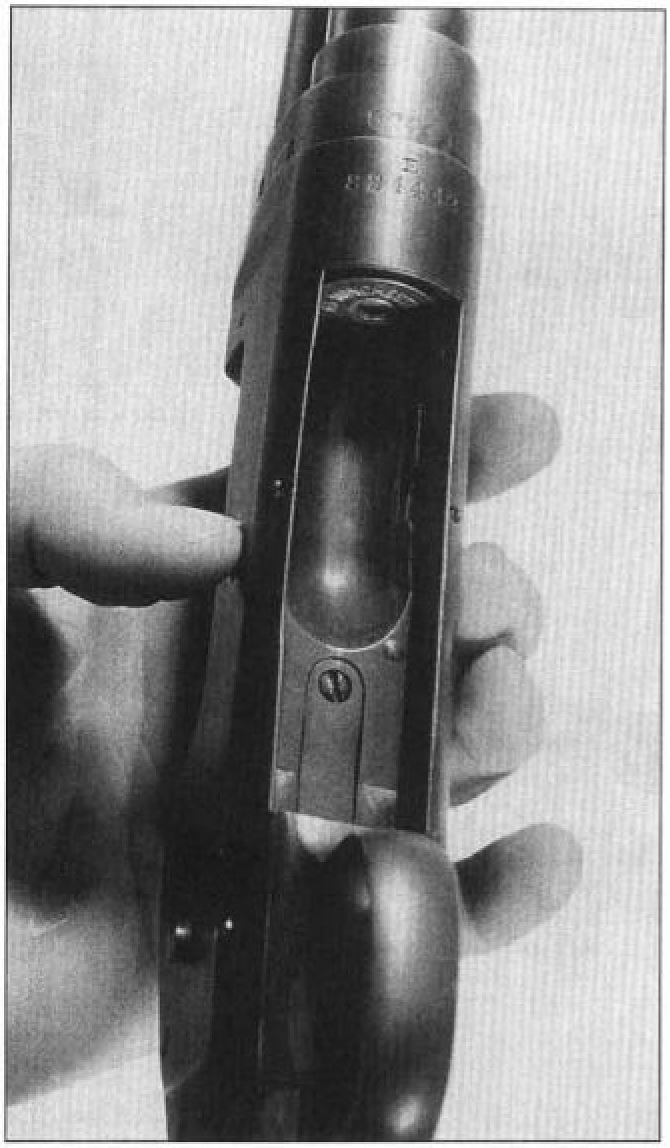


***Before plastic, brass shells were the only way to waterproof ammo*.**

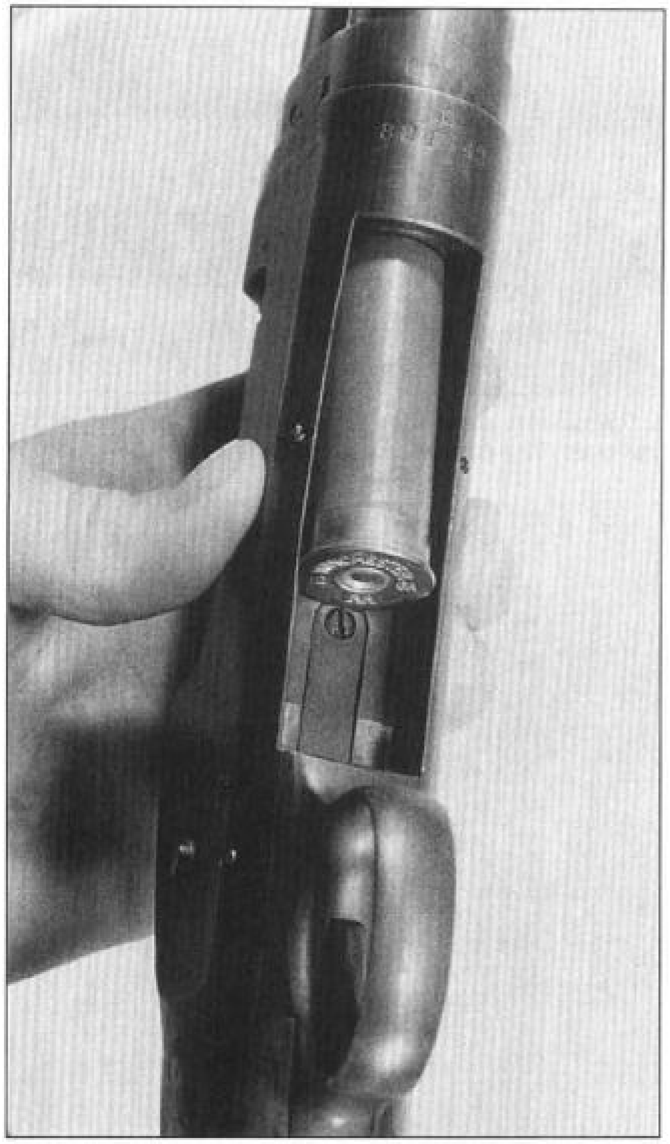
Taking the '97 apart starts out easy as we discovered in Chapter Four, but quickly becomes very involved. To dismount the barrel and magazine assembly, first make sure it isn't loaded. Turn it over and look at the magazine opening. Do you see or feel a shell? Then there aren't any rounds in the magazine. If there were, to remove them you would place the thumb of one hand over the magazine opening to control the shells as they exit, while using your other hand to press both magazine release buttons. Even in 1897 shooters knew pumping shells through the action was sloppy and hazardous. Now to check the chamber. Unlike later shotguns, the '97 has an external hammer. Also unlike later shotguns, the '97 lacks a slide release. To unlock the action you have to first use your right thumb to catch and restrain the hammer, while pulling the trigger. If the hammer was at half-cock you must fully cock it before pulling the trigger. Ease the hammer down to rest on the breechblock.

Faced with moisture-swollen shells in the trenches, any Doughboy would have been glad to have gotten plastic-hulled shells. Unfortunately, plastic didn't come around until the late 1950s. (photo courtesy Remington Arms Co.)

With your left hand push the forearm forward until you hear a click. The click is the early-unlock catch of the mechanism. A shotgun (any firearm) must stay locked at the moment of firing. Some mechanisms do not lock, but they are designed to account for their lack of locking. The '97 action will not open until the forearm has gone forward, releasing the deliberately angled surfaces of the mechanism. On firing, the recoil drives the gun back. Your forward hand, clutching the forearm, does not move back with the rest of the gun. The effect is that of your hand pushing the forearm forward during firing. The forward pressure keeps the action closed, but also unlocks the safety built in. Once recoil is over, you can easily pump the mechanism. Without recoil, you must deliberately push the forearm forward to unlock it. Many pump mechanisms have this feature, but the '97 was the first, and the strongest. Other mechanisms can wear or be over-ridden. For a while I tried to speed up my pumping times with my Remington 870 by strongly pre-loading the forearm backwards on each shot. While I could overload the early-unlock catch, I couldn't shoot any faster doing so. I got faster by being relaxed, not tense. You may think the deliberate forward motion needed to unlock the '97 slows things down, but you would be wrong. Cowboy Action Shooters are shooting well with them. The successful bowling pin shooter and gunsmith Bruce McArthur built an eight-shot Winchester '97 and used it to shoot into the loot on a number of three-man teams.



To unload the Model '97, press the magazine buttons on both sides…

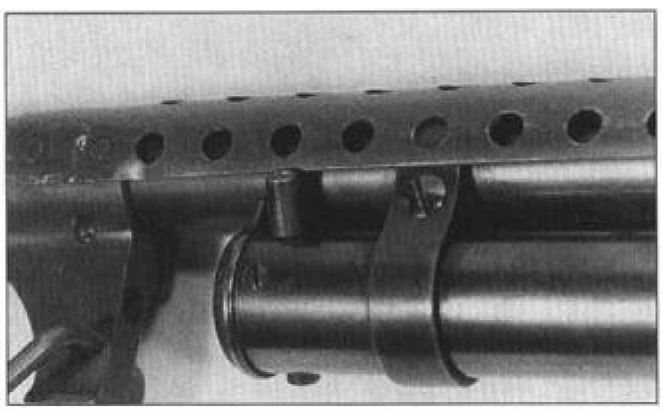


… and the shells will spring out. Next, open the action and check the chamber.

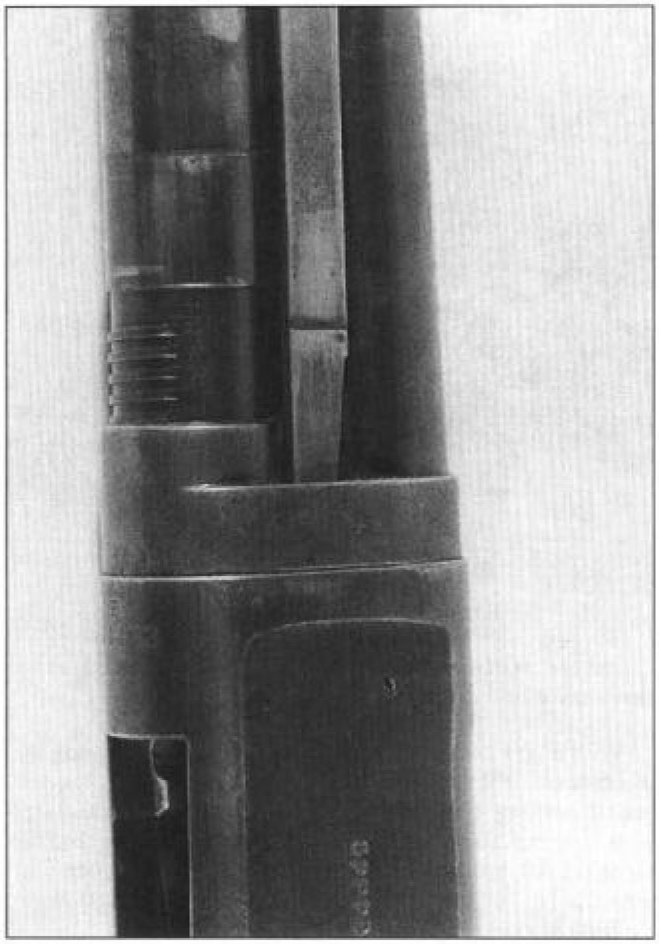
With it now unlocked, rack the forearm back, opening the mechanism. If there was a shell in the chamber, it will come out. If nothing comes out, look into the chamber and feel with a finger. You look and feel just on the chance that the extractor has broken and left the shell in the chamber. The potential cost of leaving a shell in the chamber is well worth the time of checking.

Now you're ready to disassemble. Many well-used '97's are loose in the fit of the barrel to the receiver. To check the fit, grasp the receiver with one

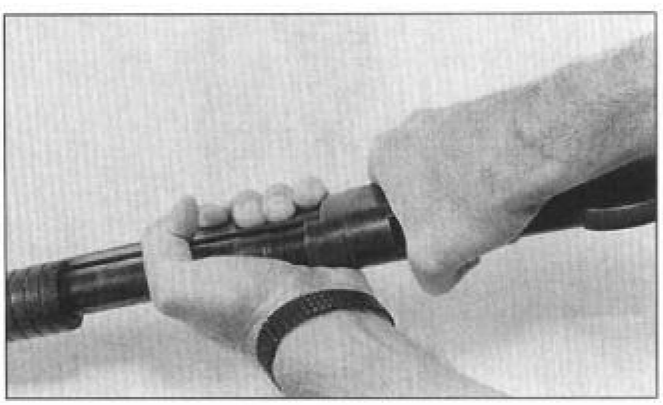
hand and the barrel assembly with another and see if there is any wobble. A properly-fitted '97 will fit together like a bank vault and have no wobble at all. If there is wobble present, you will have to tighten the fit once you have it apart. On the forward end of the magazine tube is a rod set through the tube at an angle. If properly assembled, it should be sticking up on the left side. Press the rod down, and pull it out on the bottom until it stops. Using the rod as a lever, rotate the magazine tube one quarter-turn, lifting with your left hand. (At times like these, it is easy to see that Browning was right-handed.) Grab the forearm and vigorously run the forearm forward. In so doing, you will push the magazine tube forward out of the receiver and push the action bar forward out of engagement with the breech block. Look at the side of the receiver/magazine assembly junction, and make sure the end of the action bar is clear of the receiver. If it is not, you will not be able to turn the magazine assembly. Grab the barrel and magazine assembly at its base, right next to the receiver. Rotate the assembly a quarter turn clockwise, and pull the assembly forward out of the receiver. Leave the hammer cocked.



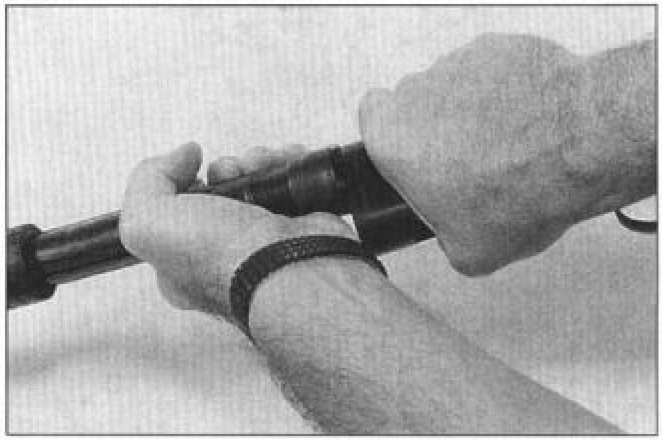
1. Disassembly starts with the pin in the end of the magazine tube. Press it down and use it to turn the tube.



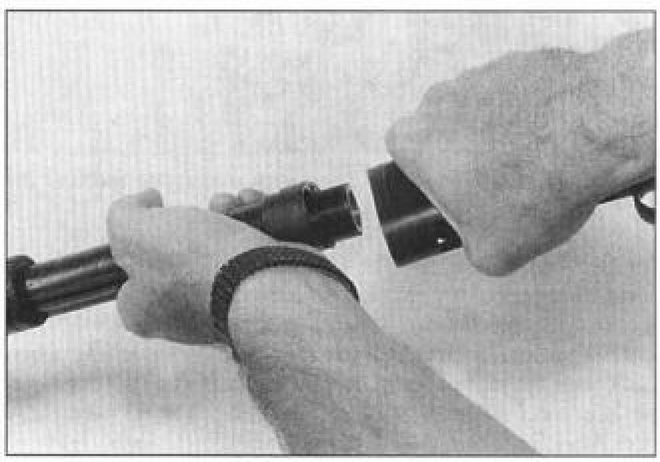
2. Running the forearm forward now pulls the magazine tube out of the receiver.



3. Grasp the barrel and magazine tube by the connector shoulder…

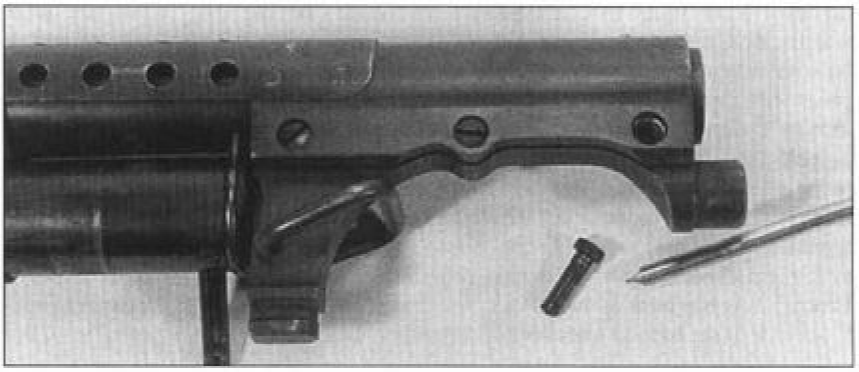


4. … and turn the assembly.



5. You can now pull the assembled front half off the

If you happen to have a Trench Gun, you must remove the heat shield before disassembly.



With the screw out, use a mallet to tap the heat shield off the barrel.

The easy part of the disassembly is done. For the rest you will have to have screwdrivers. To reassemble it you will need those same screwdrivers and a slave pin.

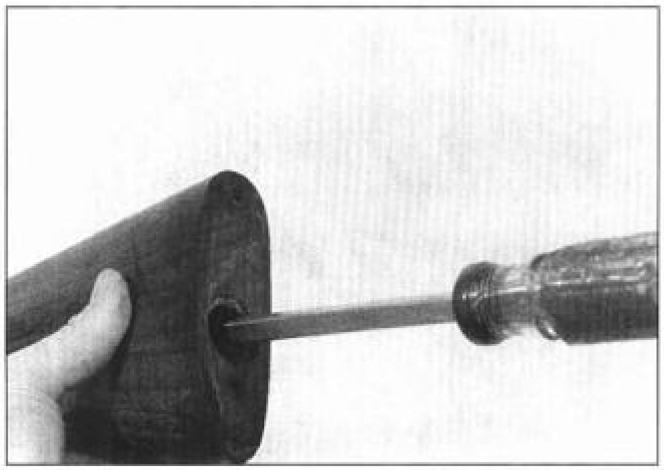
Disassembly

First comes the buttstock. Remove the buttplate and then unscrew the stock bolt. If all you want to do is repair the stock, jump ahead to “97 Stocks” and take care of the wood.

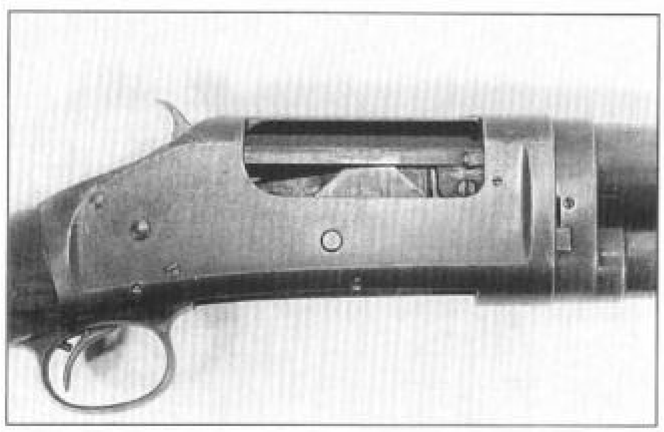
Holding the action (with or without the stock) look at the rear of the receiver, next to the hammer. To the left of the hammer is the carrier pin stop screw. Unscrew and remove it. Put your thumb on the hammer and pull the trigger, and ease the hammer down. The carrier is now unlocked. Use the screwdriver to pry it part of the way down from the bolt. Now cock the

hammer. (If you don't lower the hammer to start, you can't unlock the carrier. If you don't then re-cock the hammer, you can't get the carrier out.)

On the rear sides of the receiver near the hammer are the heads of the carrier pin. Press the pin out. On the right side of the receiver above the trigger is the cartridge guide slop screw. Remove it. You can now pull the carrier assembly down and out of the receiver.



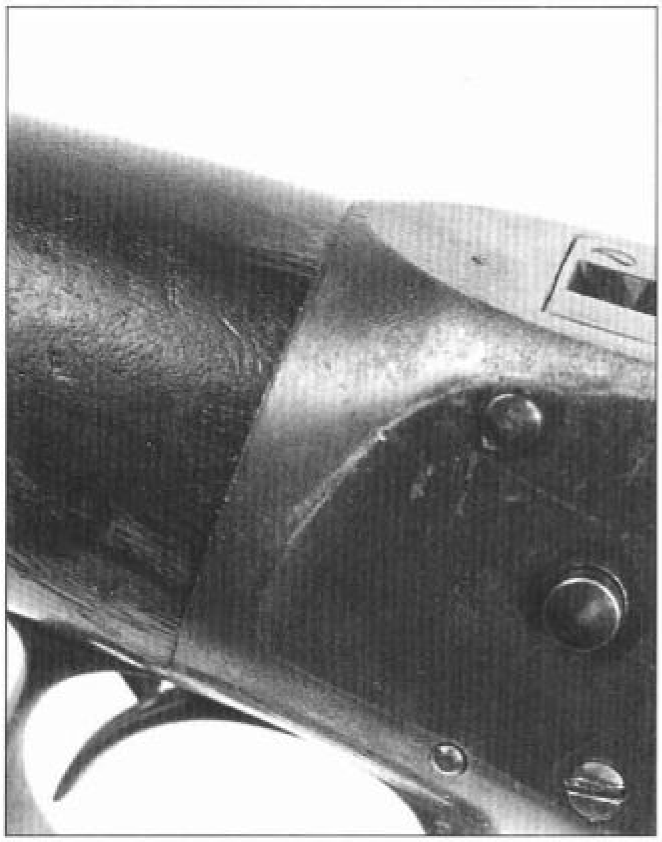
The buttstock is held on by a bolt through the stock.



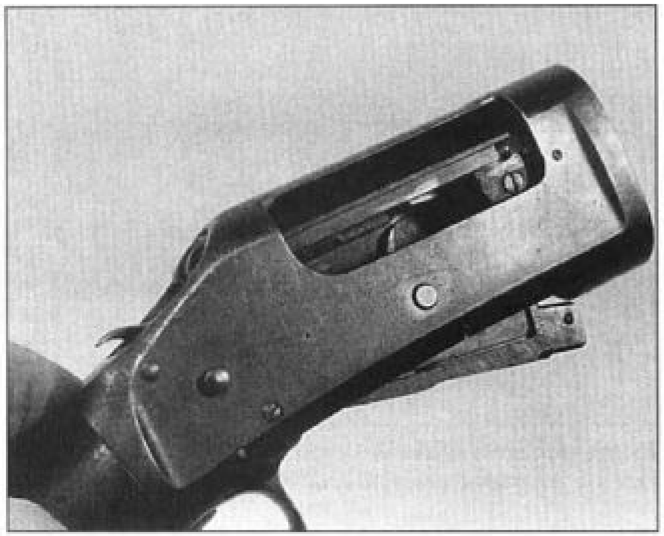
By the standards of the day (and still today) the Model '97 receiver is compact, smooth and sturdy.

Turn the receiver onto its right side, and look into the ejection port. On the bottom side of the bolt you'll see another large screw. It is the action slide hook. Unscrew it and remove the screw and the hook from the bolt. You can now slide the bolt out of the rear of the receiver.

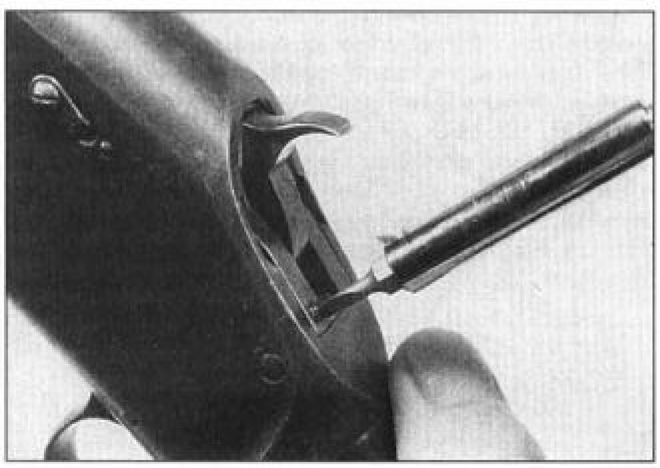
If you want to remove the trigger guard, you should take the buttstock off. While the '97 does not pull directly in the trigger assembly as in the Ithaca, pressure from the stock can interfere with easy removal of the trigger assembly pin. Press the pin out from either side.



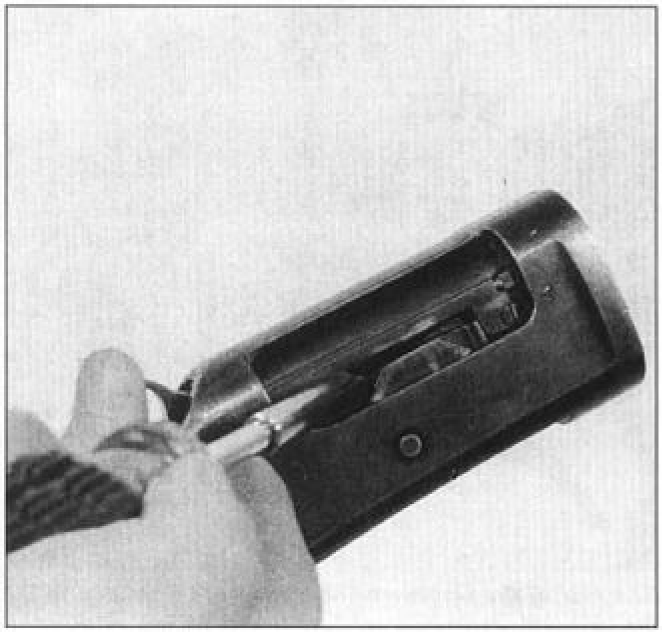
The rear of the receiver is a busy place. In addition to all the pins and screws you see here, the stock bolt anchors in the rear center of the receiver.



1. This is the receiver ready for disassembly.



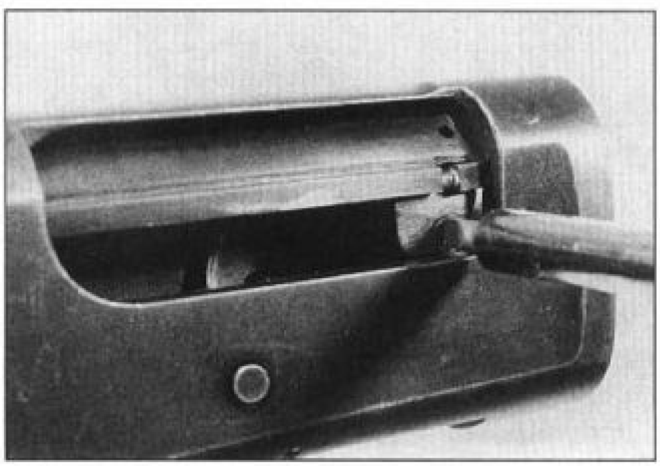
2. The carrier pin is held in place by the screw to the left of and behind the hammer.



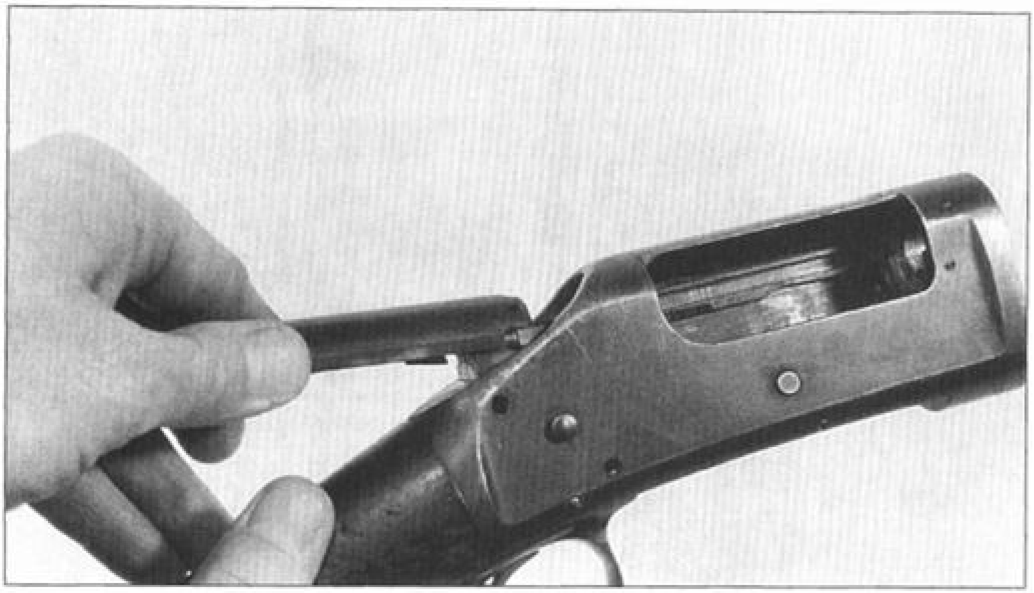
3. Pry the carrier down out of engagement.

4. The carrier limit screw must be removed to pull the carrier out.

5. With the pivot pin and limit screw removed, you can pull the carrier out through the bottom of the receiver.



6. The bolt is held to the link hook by a large screw.



With the screw out, pull the bolt out from the rear.

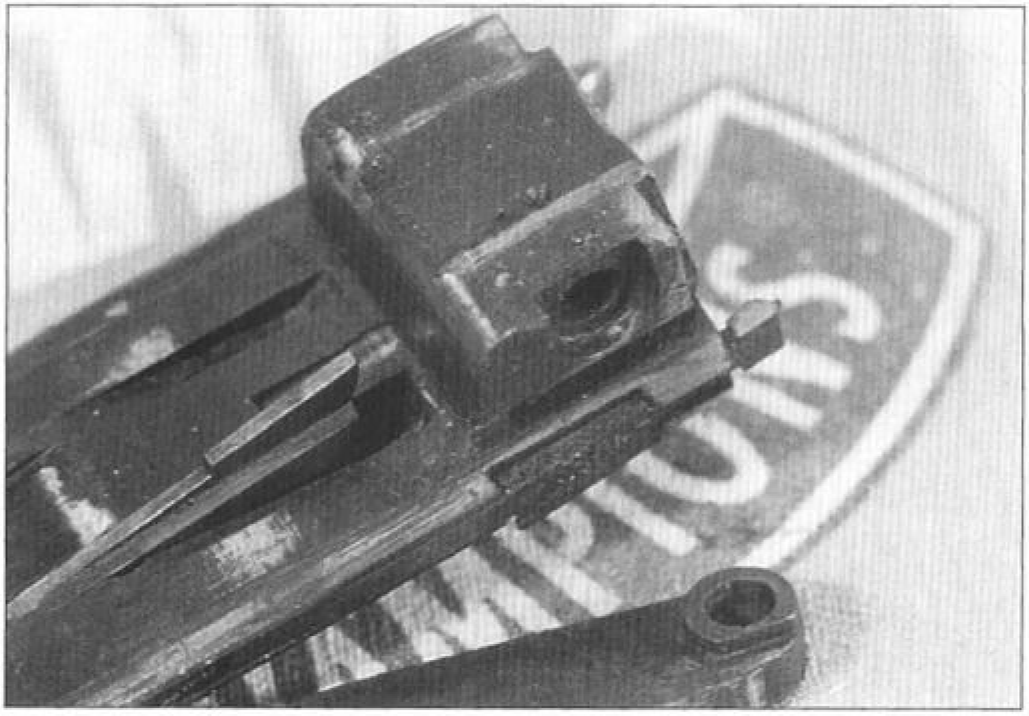
The trigger pin not only holds the trigger guard in place, it is the pivot pin of the trigger itself. When the trigger guard comes off the trigger, its spring will fall out.

To reassemble you'll need a slave pin. The slave pin should be a free and smooth fit through the trigger guard, and have rounded ends. Slide the slave pin part of the way into the trigger guard and press the trigger spring and trigger into place. Press the slave pin through to capture the trigger. Set the trigger assembly aside for the moment. Slide the bolt into the receiver and press it forward. Press the action slide hook into place and fasten its screw. Take the carrier and slide the rear end up into the receiver and line up the carrier pin hole. Slide the carrier pin through, with the notch on the left side of the receiver. Reach underneath the carrier and press the sear, and lower the hammer. You can now pivot the carrier up to the bolt. To hold the carrier in place while you finish, cock the hammer.

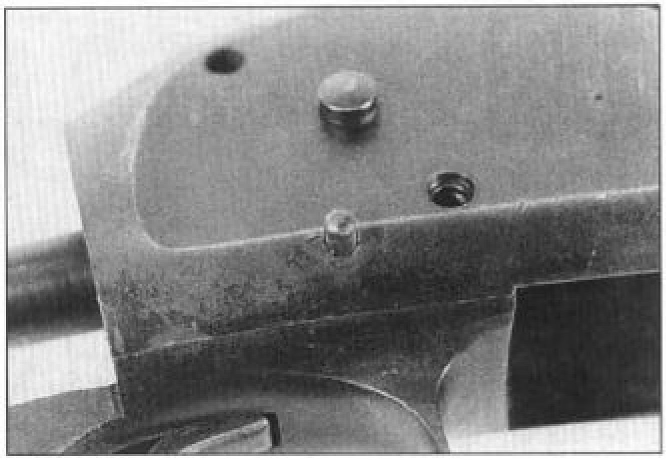
Now take the trigger assembly and press it into the receiver. Line up the trigger pin holes in the trigger guard and the receiver. Press the trigger pin into place, pressing the slave pin out as you do.

From here, reassembly then proceeds to replacing the stock, and installing the barrel/magazine assembly.

You can see how the hook fits into the bolt.

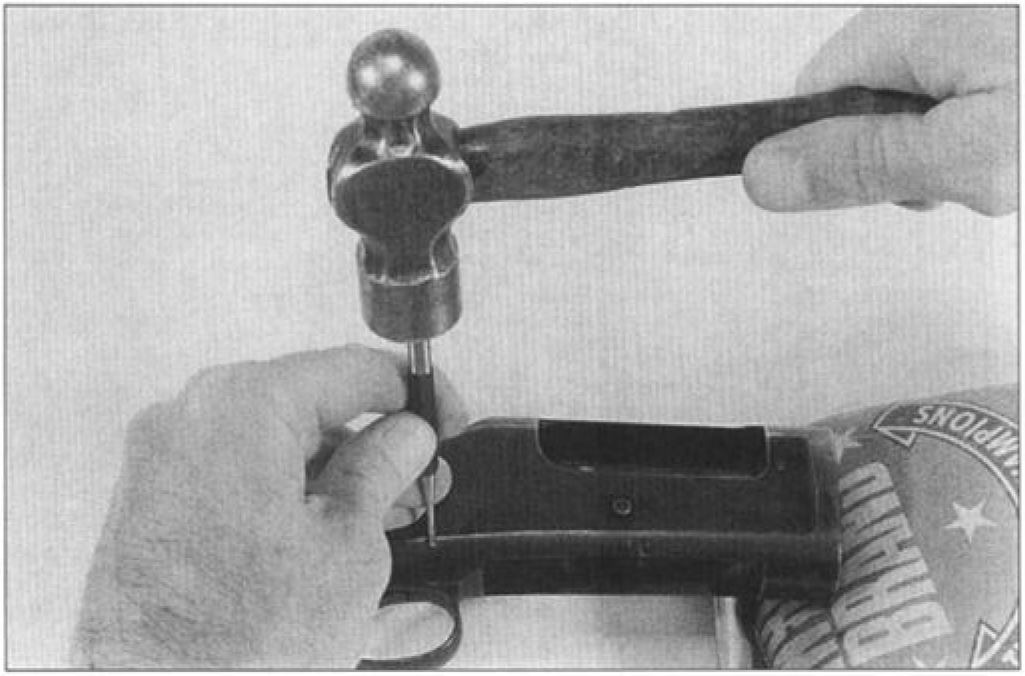


The pin just above the trigger guard holds the guard and trigger in place.

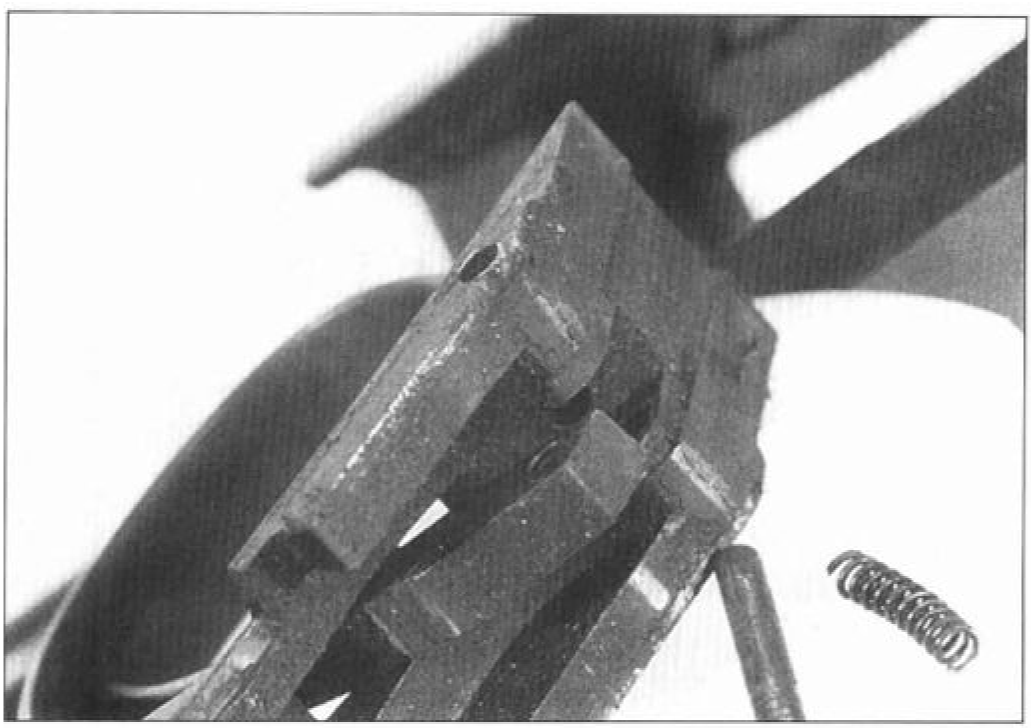


The pin is retained by friction.

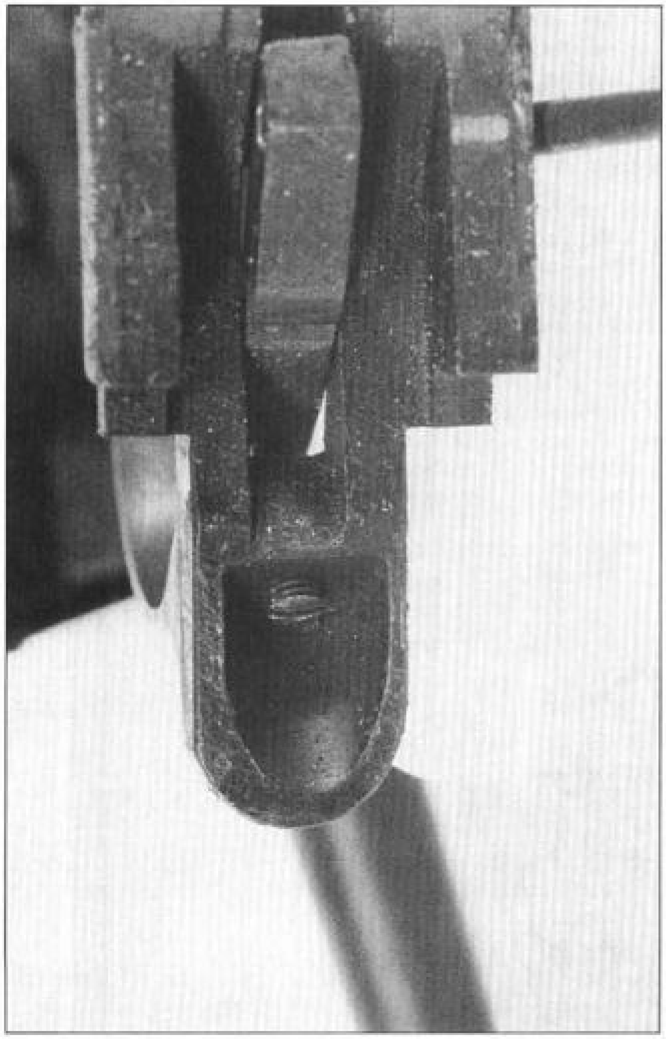
Use a punch to press it out.



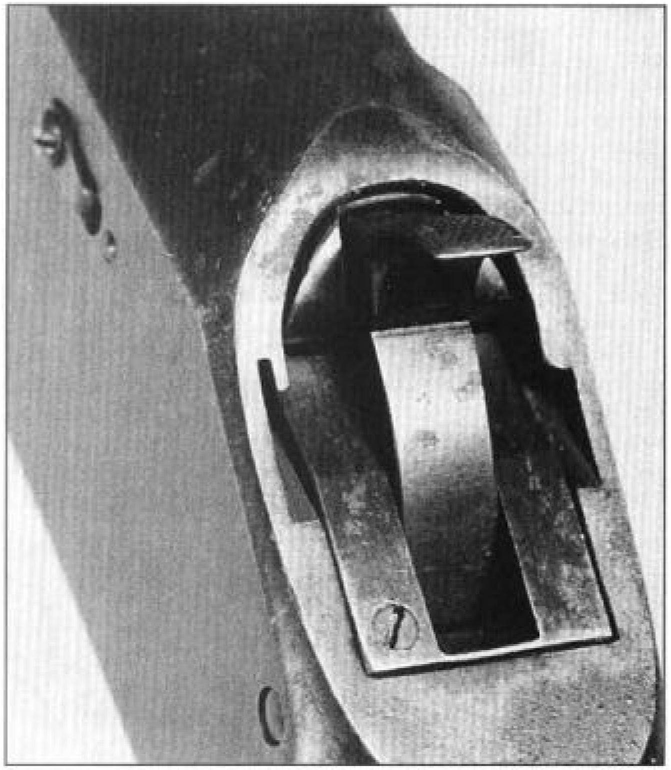
Or, if it is stubborn, tap it out with a hammer and punch.



The assembly is simple, with only one part and one spring, but you'll need a slave pin to reassemble it.

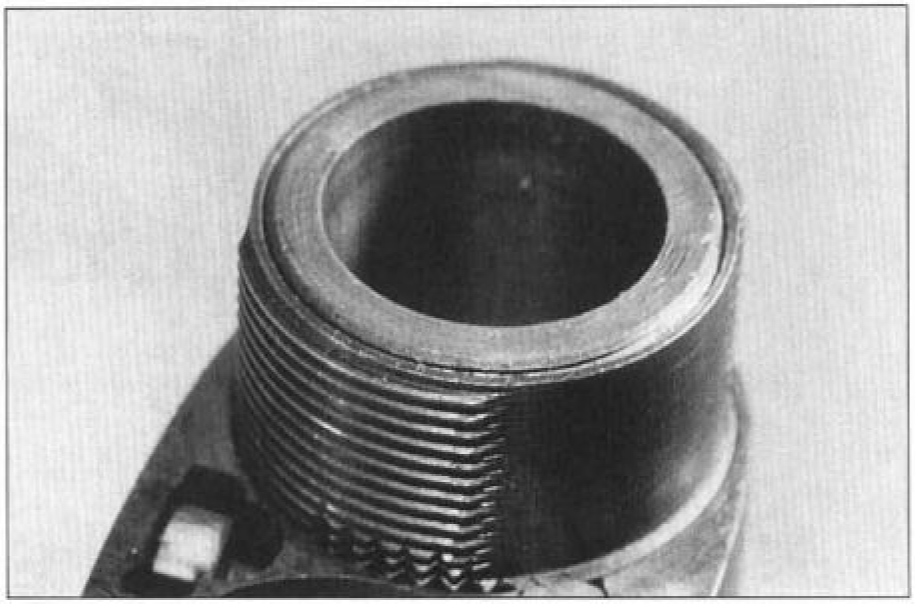


At the rear of the trigger assembly is a trigger stop adjustment screw. Unless someone has already adjusted it incorrectly, leave the screw alone.



Here is the carrier pin retaining screw. You must remove it to disassemble the receiver. Use a correctly fitted screwdriver.

The barrel appears as a tube in a tube, both threaded. The barrel ends in the middle of the chamber



The forcing con

Unlike the Ithaca, the Winchester '97 extractor is kept from the barrel assembly by an internal collar. While it makes disassembly easier, it makes measuring the chamber length more difficult. To measure the chamber on your '97, place the chamber gauge in the chamber and leave it there. Take your dial calipers, and using the tail as a depth gauge, measure the distance from the face of the receiver to the face of the closed bolt. Lock the calipers open at this distance. Place the tail of the calipers on the face of the barrel assembly soulder, and compare the caliper measure to the distance to the chamber rings on the gauge. If you are reaming the chamber to lengthen the forcing cone or slightly deepen the chamber, you will have to keep your calipers locked to the measurement and repeat this process each time you wish to check your progress.

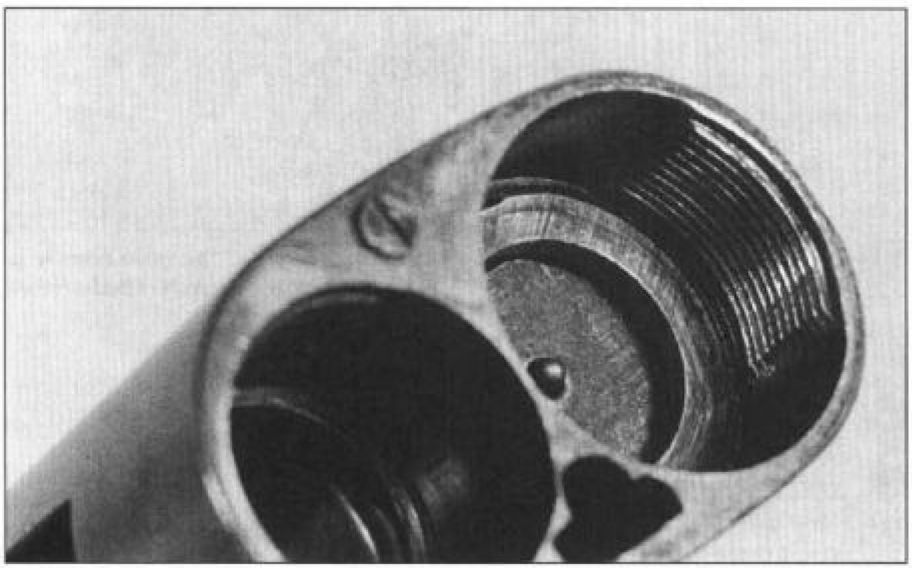
The '97 construction does make lengthening the forcing cone a bit easier. Your view of the forcing cone is unobstructed. On other shotguns, the full length of the chamber stands between you and the forcing cone. If the barrel has an extension for the locking block of the bolt (especially prominent in the 1100) you have to peer at the forcing cone from a distance. On the '97, the barrel ends at 1-½ inches behind the forcing cone. Your view is clear and unobstructed.

Follow the regular procedure for reaming the chamber and forcing cone, checking your progress visually and by measuring with the locked-out calipers.

Once the locked measurement of the dial calipers matches the chamber depth notch on the gauge, your chamber is the correct depth.

A loose fit

The receiver has a stop collar for the rear of the barrel. The stop collar protects the extractors during assembly and disassembly.



If you look closely at the rear of the barrel, you will see that the back end of it appears to be two tubes, one tube inside another. The inside tube is the barrel itself, threaded into the assembly collar. The outside tube is threaded on its inside and outside. The threads inside screw onto the barrel, and on the outside they fit the receiver. Winchester calls the outside tube the djusting sleeve. On the right side of the rear face of the assembly collar is a small block. The block locks the adjusting sleeve in place on the inside tube (the barrel). Loosening the block and turning the adjusting sleeve allows you to tighten the fit of the barrel assembly to the receiver. With a small screwdriver, loosen the locking screw of the adjusting sleeve locking block. Once the screw is loose, use the screwdriver to pry the block back away from the adjusting collar. Once the teeth of the block are free from the

notches of the collar, grasp the collar (you may have to use padded pliers) and turn the adjusting sleeve one notch worth into the assembly collar. Press the locking block back in place and check the fit of the assembly on the receiver. To check, insert the rear of the barrel into the receiver and turn to lock the barrel into the receiver. Check for wobble. If the wobble is still present (it should have been reduced by your adjustment) remove the barrel, pry the locking block away from the adjusting sleeve and turn the sleeve one more notch tighter. Continue adjusting and checking until you can hand-tighten the barrel into the receiver, but there is no wobble present when assembled. You do not gain anything by over-tightening the fit. If you adjust the sleeve so tightly that you need pliers or a wrench to turn the barrel assembly into line, you just make it more difficult to disassemble for future cleaning. Once the fit has been adjusted, press the locking block into the notches of the adjustment sleeve and tighten the locking screw.

To measure headspace you must measure the correct pair of distances, here the length from the bolt face to the collar front is compared to…

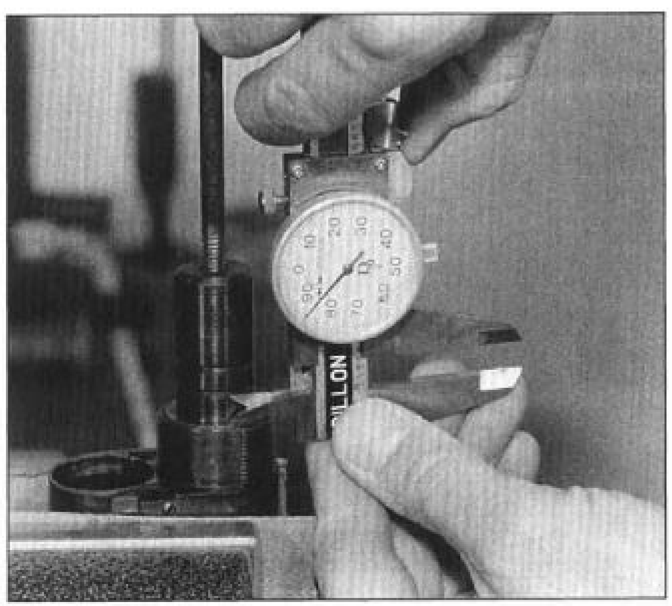
If you have a seriously worn '97, and all of the adjustment has already been used up but the fit is still loose, you need a larger collar. To get one, you will have to determine the size of yours. The standard size adjusting sleeve is unmarked. The adjusting sleeve part number for the Winchester '97 is the same as the adjusting sleeve for the Winchester M-1912, and is interchangeable. The larger sleeves are known as “Heavy Draw” sleeves. Each size of the Heavy Draw adjusting collar is numerically marked,

increasing with size. Next up from the standard is the “1”, then “2”, up through “6”. To tighten your loose '97 that has no adjustments left, you will have to locate a Heavy Draw adjustment sleeve from a used parts dealer like The Gun Parts Corporation or Jack First.

With the Heavy Draw sleeve on hand, you loosen the old sleeve and unscrew it from the barrel. Screw the Heavy Draw sleeve on and fit it in the same manner as you would the old sleeve. Once the new sleeve fits properly, tighten the locking block and its screw and reassemble the shotgun.

An alternative is to file an extra notch in the sleeve. If the last notch almost makes the fit tight enough, you can unscrew the sleeve and use a triangular file to file another notch. While doing this saves the cost of a Heavy Draw sleeve, it also puts less of the interrupted threads of the old sleeve in engagement with the receiver. If you are tightening an old family heirloom so it can be used on an occasional outing once or twice a year, go ahead and file the extra notch. If you are building a '97 for competition, where it will see heavy use, or defense, where perfect operation is critical, buy a Heavy Draw sleeve and fit the action properly.

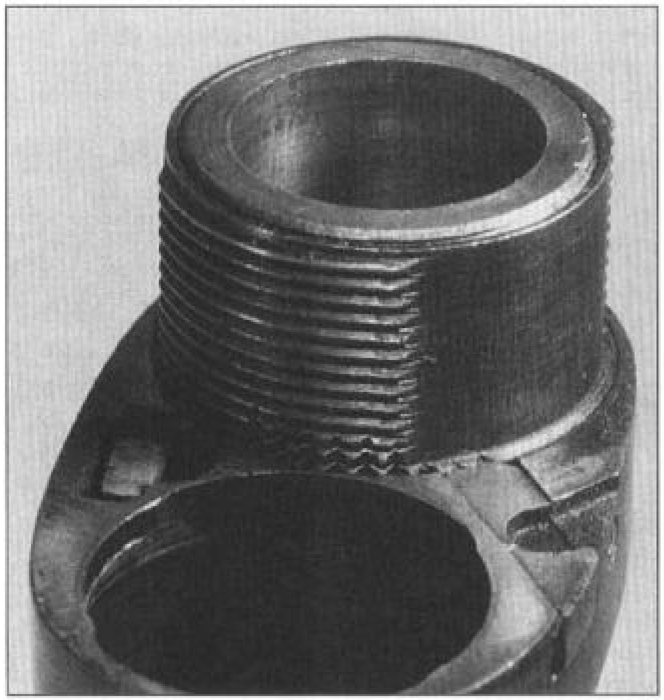
'97 Stocks



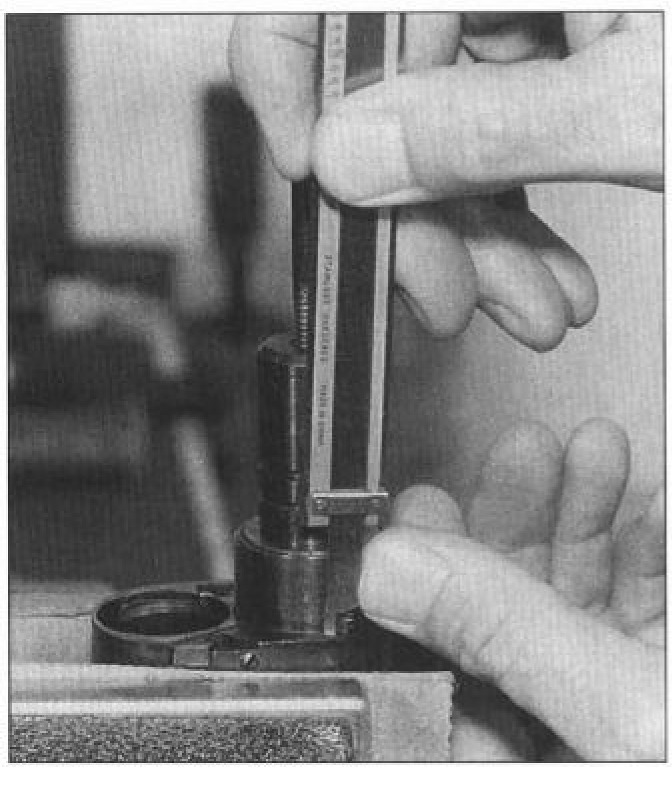
…the barrel end to the groove in the chamber gauge.

The only consistent weakness of the stock seems to be right at the wrist, where it joins the rear of the receiver. The stock is attached to the receiver by means of a large bolt that goes in through a hole under the buttplate and pulls against the rear of the receiver. The wrist of the stock is well shaped and proportioned, but the hole through its center weakens it slightly. It is not unusual to see '97s with two small cracks, one on each side. Once cracked, the stock seems to go on forever. I have heard shooters decline fixing it with the observation “My dad first saw the crack back when Johnson was President. It hasn't gotten any worse, so why worry?” Why, indeed?

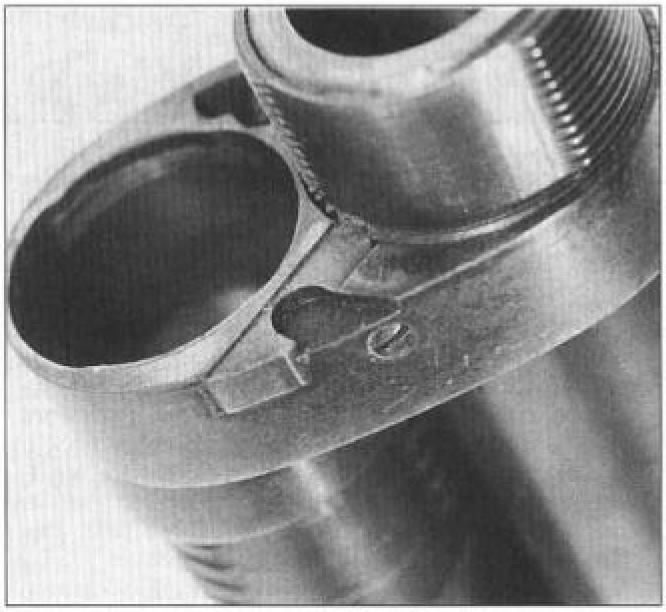
Or, you can measure from the bolt face to the front of the receiver…



The draw collar is locked into place by a toothed tab that slides into engagement.

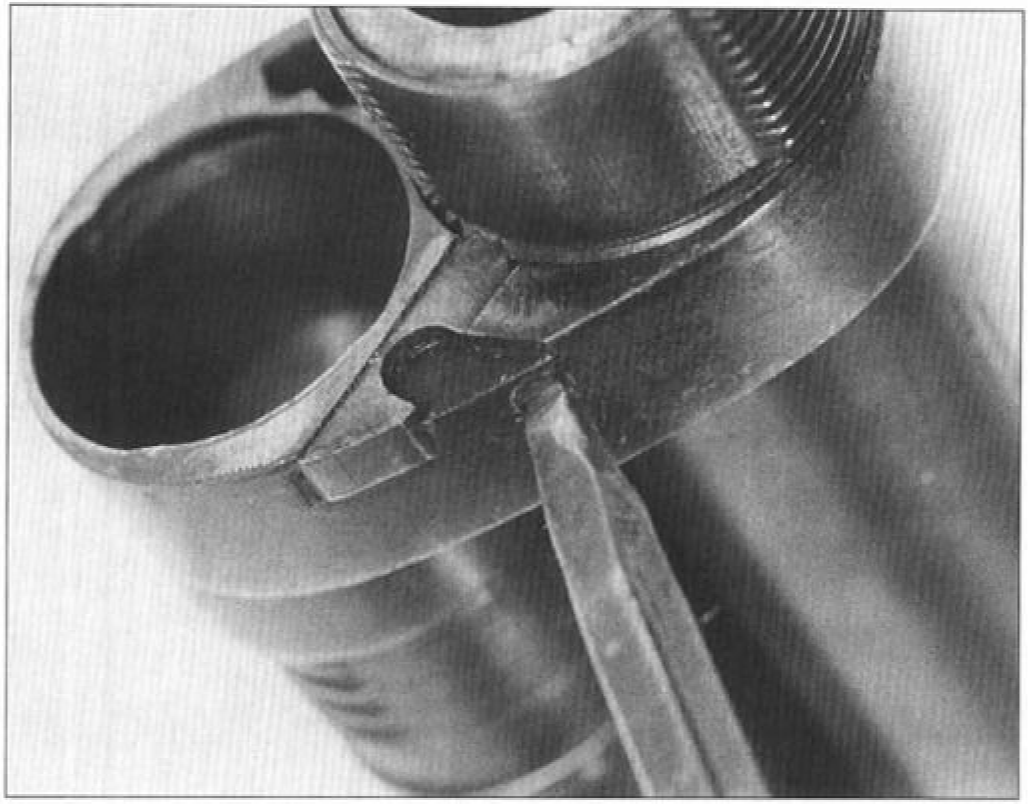


…and the barrel collar to the groove in the chamber gauge.



This shot shows the draw collar, its locking tab and the screw that keeps the tab in place. This is a solid design, if you are going to have a shotgun with a magazine that comes off with the barrel. The slot over the locking screw is for the screw in the front of the receiver that keeps the locking tab in place. John Browning was a belt-and-suspenders kind of guy.

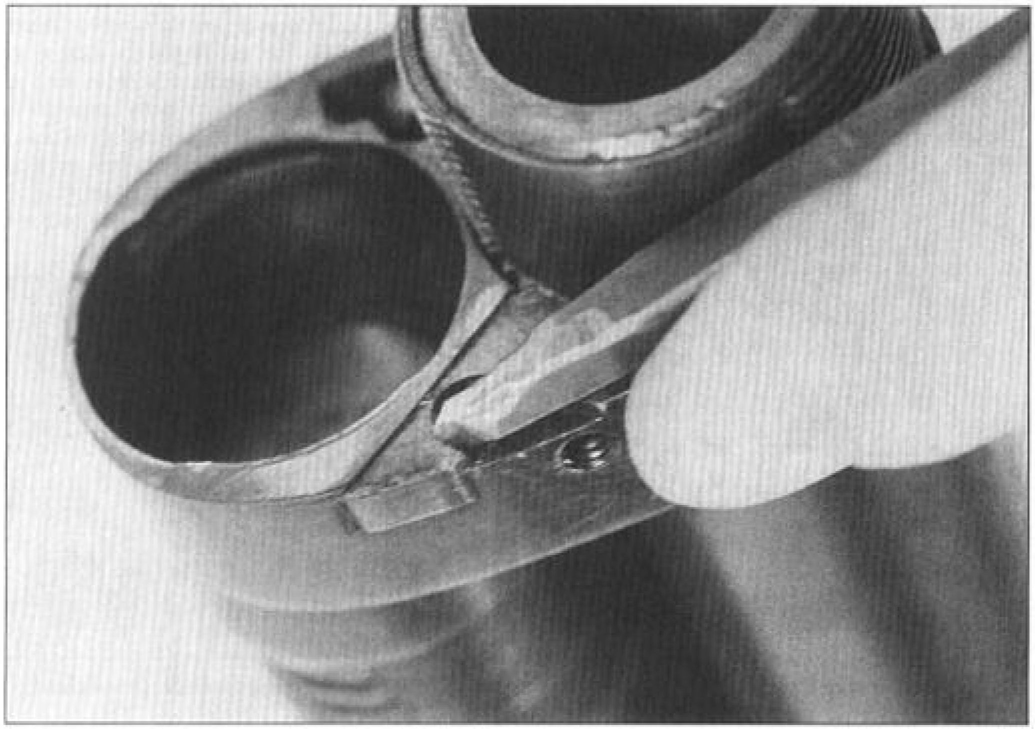
Because gunsmiths fix things, that's why. To fix these cracks you'll need AcraGlas or Aeradas Gel from Brownells, a hand-held grinder, degreaser, release agent and small screws or thick wire. You will also need some dental drill bits. Remove the buttplate and reach inside the stock with a large screwdriver. If you cannot loosen the stock bolt by hand pressure, clamp the receiver in a padded vise and apply both hands to the screwdriver. In extreme cases you may have to use a crescent wrench on the screwdriver shaft to get enough leverage to loosen the screw. If the screw is this difficult to remove, delay your stock fixing plans for a few minutes to attend to the stock bolt and its fit.



Unscrew the locking screw.

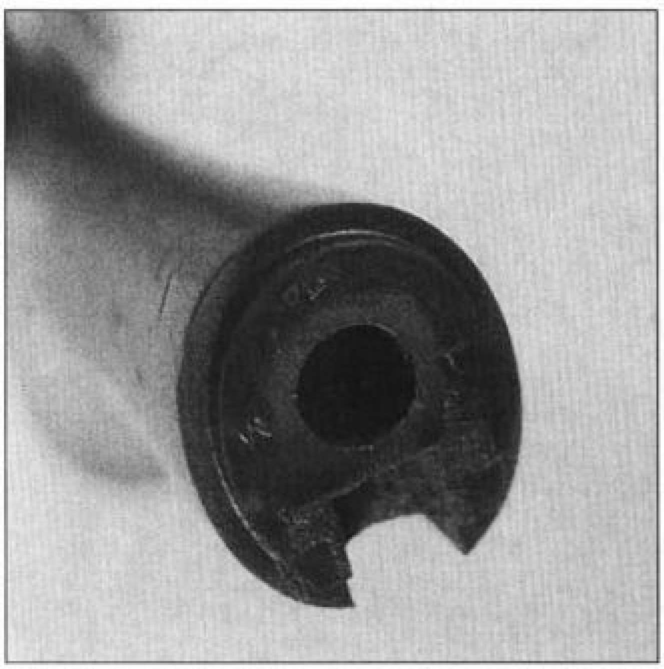
The holt is most likely hard to remove because of rust. Use a wire brush on the threads of the bolt to clean them. Take a brass bore brush (.25 caliber will do, and will be used up in the process) and screw the brush up into the receiver extension that the bolt screws into. Unscrew the brush. Take a .22 caliber plastic brush and brush the shaft out. Lightly oil the bolt threads and screw the bolt into the receiver. Then unscrew it. You will do more once the stock repair is done, but the threads will be clean enough for you to proceed with the stock repair.

Pry the tab away from the draw collar.

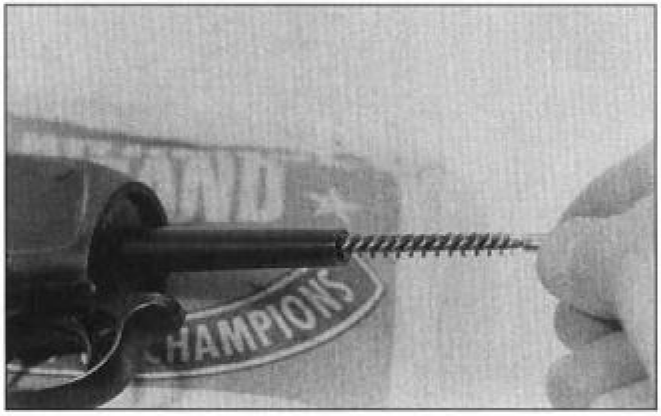


Clamp the stock in a padded vise positioned so you can easily see and reach the cracked area. Put a dental drill bit in your hand-held grinder. Carefully cut two slots in the end of the stock, following the curve of the wrist, and staying along the raised shoulder. Each slot should cross a crack. With the drill bit, plunge down into the end of the stock at the location of the crack, to give the epoxy more purchase on the crack itself. Cut two pieces of reinforcing wire, each the length of the slot, and bend them so they conform to the curve of the slot. Mix your epoxy and degrease the wires and wood. Place the wires in the slots and apply the epoxy. Leave the epoxy fully covering the wires, but not completely filling the slots. You must now clamp the repair. Wrap the wrist with Brownells surgical rubber tubing to clamp it. If you do not have the tubing, large rubber bands will do. In a pinch, place a sheet of plastic wrap over each side of your vise with the smooth jaw faces installed, or with padding on the faces. Gently compress the wrist from the top and bottom with the vise until the stock is held and compressed to shape. Leave the stock to cure overnight.

You can now tighten the fit. If you've used the last notch, you can file one more, but no more than that. Four notches past the threads is all you can have.

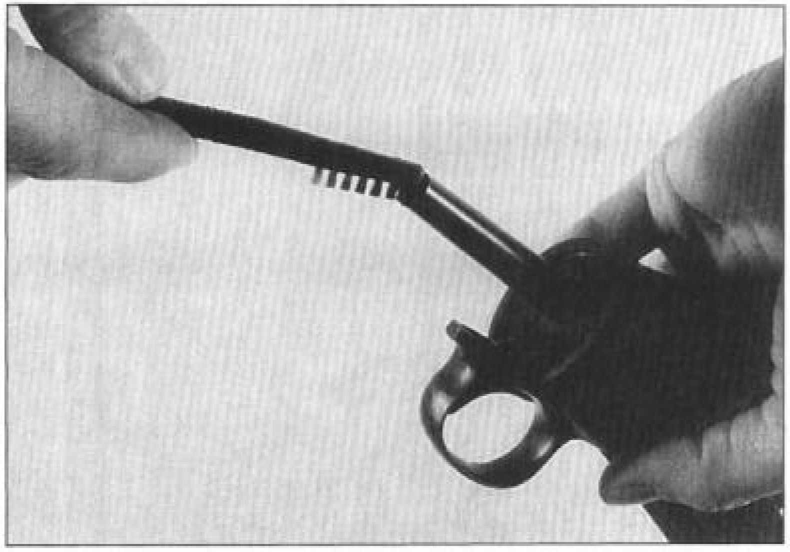


The stock wrist is narrow for a good grip, and the receiver shaft is large to take a large screw. The result is a wrist that sometimes cracks and needs repairs.



To clean the stock bolt threads, use a .22 or .25 caliber bore brush.

With the stock curing, turn your attentions back to the stock bolt. Check the fit of the bolt to the receiver. If there is still so much gunk in the threads that the bolt is difficult to turn in and unscrew, brush the bolt threads and receiver threads again. You must use brushes. One of the peculiarities of the firearms field is the depressing regularity of oddball threads. That is, rather than use a standard thread, manufacturers, in many cases, designed a unique size for their screws. The pitches are standard because the screws come off a lathe or screw threading machine, but the sizes, oh! The stock bolt on a '97 is a .208″ × 28 size. Outside of the Winchester factory of 50 years ago, you will not find a tap that size with which to clean out the threads.



***The small end of a cleaning brush is not small enough*.**

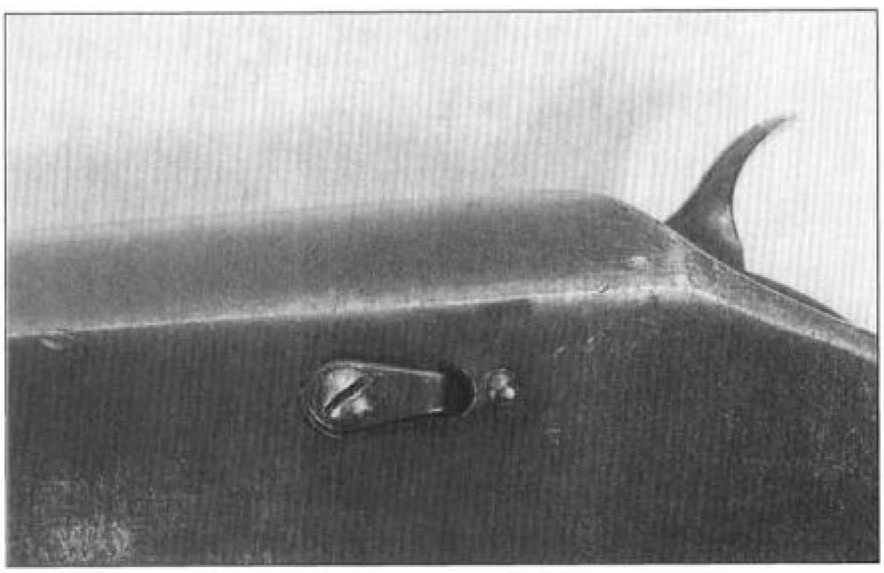
Once the threads are clean enough to allow easy assembly and disassembly of the stock bolt, apply either gun grease or anti-seize compound to the threads. When you are done with the stock, it may stay in place for many more decades. Make the next guy's stock removal job a little easier.

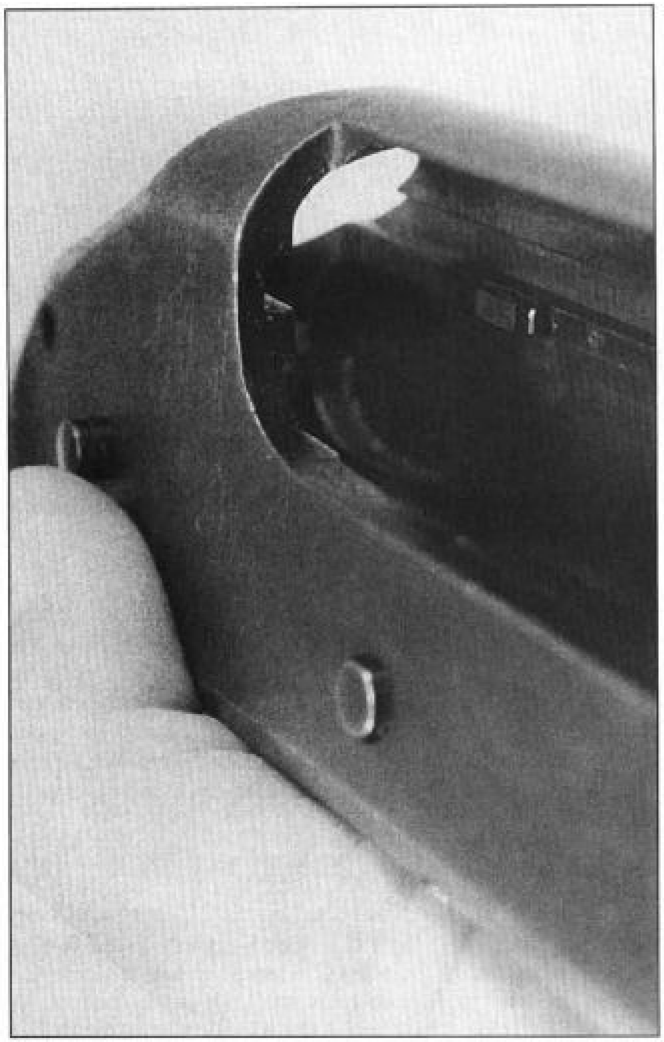
With the epoxy cured, remove the stock from the vise and take off the rubber hose. Slide the stock onto the receiver to check the fit. If the epoxy sits a little high in some areas and keeps the stock from sitting flush to the rear of the receiver, use a clean fine-cut file to dress the high spots down. Once the stock fits flush, rough up all the face of the stock where it fits, both wood and epoxy. Scrub the rear of the stock clean and apply a layer of release agent. Mix a small batch of epoxy and apply an even layer to the face of the stock. Slide the stock on and tighten the stock bolt only finger tight. If you tighten the stock as if it were to be installed for shooting, you'll squeeze all the epoxy out of the joint. Wipe away excess epoxy with a stiff card. Let the epoxy cure. The next day remove the stock and with your file, dress down excess epoxy that might have oozed out of the joint after you left it alone. Reinstall the stock and stock bolt, and the buttplate or recoil pad.

'97 Ejector

If there is a small and weak part on the '97, it is the ejector. Simply a piece of spring steel shaped vaguely like a fishing hook and fastened to the side of the receiver with a screw, the ejector does its job by being in the path of the rim of an extracted cartridge. I have wondered why Browning put such a small part into a crucial role, but for the number of '97s being used, the little thing doesn't break that often. Still, if it breaks you are out of commission until you can replace it, so it would be a good idea to obtain an ejector and screw beforehand. Replacing it is simple. Unscrew the fastening screw. Pull out and discard the broken ejector. Use the screw to fasten the new ejector. Maybe that is why he designed the ejector this way, so replacing it would be a two-minute job.

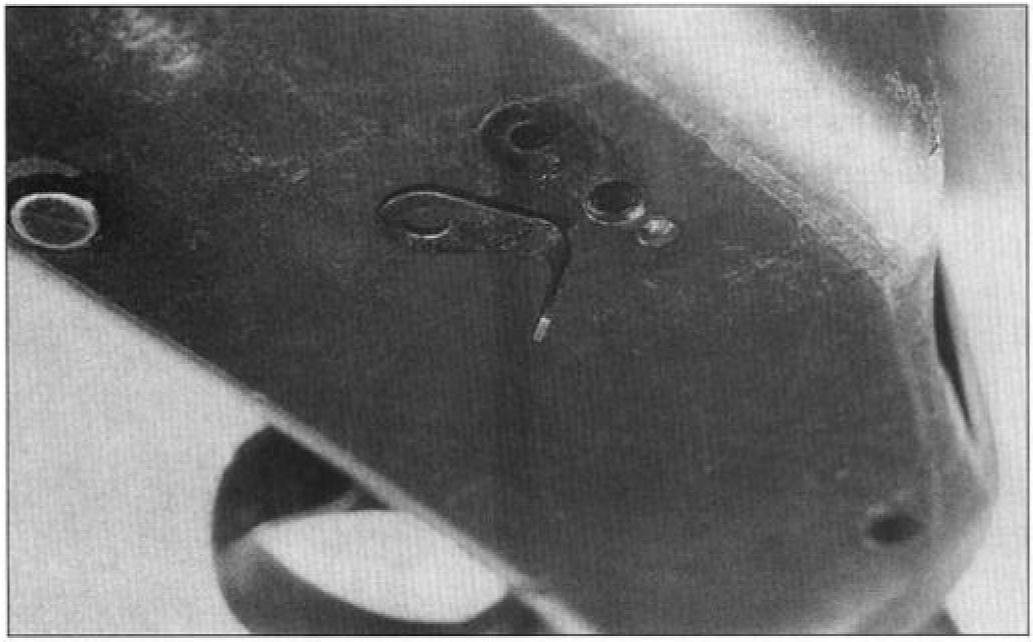
***The ejector is a small but solid design, and easy to replace*.**





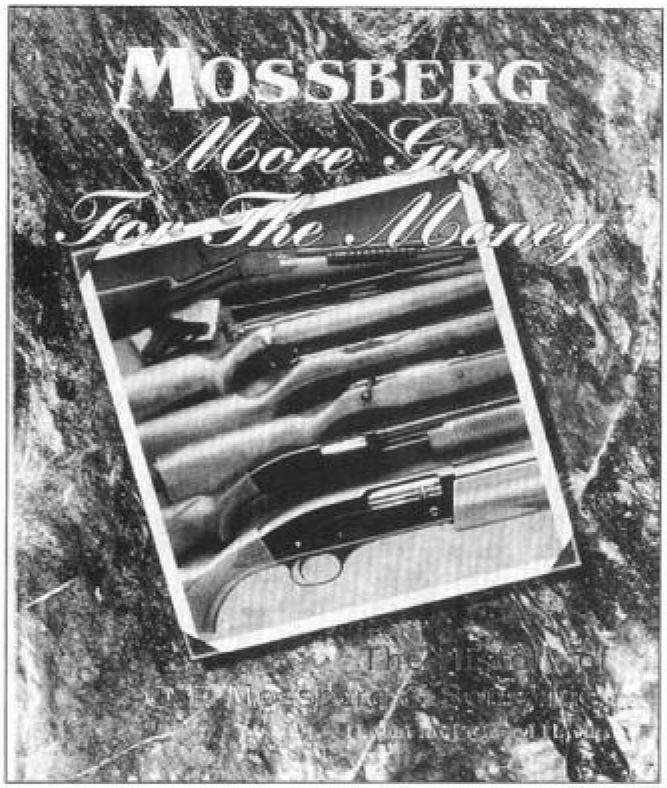
The ejector sits in place in the receiver, and acts as a pivot, knocking the shell out of the receiver.

Use a properly-fitting screwdriver to remove the ejector screw.



As simple as it is, you'd think the ejector would break more often, but it doesn't. This one has been going strong for more than 80 years.

CHAPTER 13
The Mossberg 500



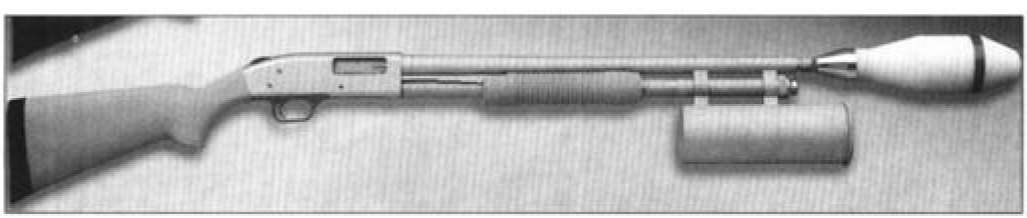
If you want to know more about the history of the 500, Victor and Cheryl Havlin can provide it.

The Mussberg 500 is one of those “love-'em-or-hate-'em” shotguns. Either the advantages it offers make a difference to you or they don't. Either the lower cost matters or it doesn't. The Mossberg is almost unbreakable except for the safety button and some trigger assemblies. Anyone who needs a durable shotgun simply must give it a look. I first used a Mossberg in a practical competition match in 1978, and I don't think I've been without one since. Its only draw-back for the is that I cannot seem to pump one as fast as I can pump other shotguns. Lest you think this is a serious problem, I am talking fractions of a second at the end of an eight-shot magazine. My best time with a Mossberg on an eight-pin table is 4.0 seconds, while my best time with another brand is 3.7. In this example, the average extra time

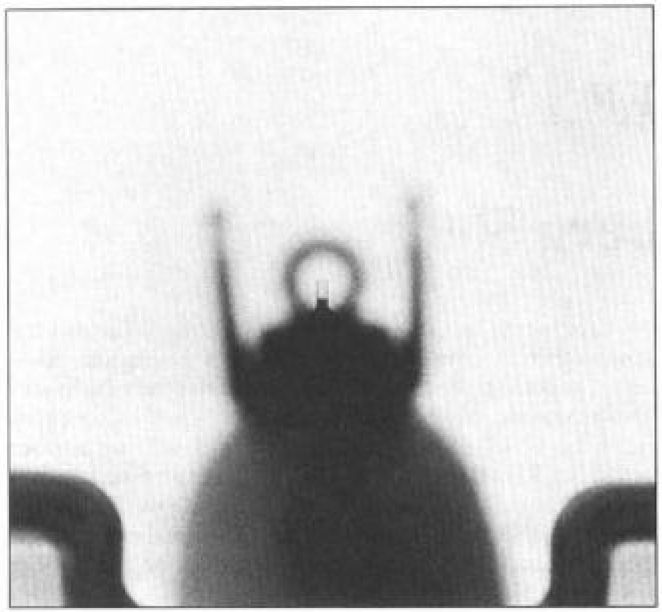
between pumped shots is .042 seconds. When hunting ducks, the difference in split times between the Mossberg and other pumps doesn't matter. How far can the fastest duck or goose fly in .042 seconds?

The Mossberg 500 line includes all the 500s and their letter suffixes, 500A, 500B, etc., the 600 series, the New Haven guns, the 590s and the Maverick line. Not all will have every Mossberg feature. The 590s have open-ended magazine tubes, and the Mavericks have safeties built into the trigger mechanism. For general work that is the same on all models, I'll refer to all models by the moniker “500.” For model-specific work, I'll use the mode) number in particular.

The first production Mossberg 500 saw the light of day in August of 1961. Consider the entrenched competitors it had to deal with; the Remington 870, Ithaca M-37 and the Winchester Model 12. All three featured a forged, machined steel receiver, and at least a decade's head start. The Winchester had been around forever, the Ithaca since the end of the Depression, and while the Remington was “only” a decade old, the company had been in the business of making shotguns since anyone could remember. While externally similar to other pump shotguns, and using the same operating principles, the Mossberg 500 offered several improvements, even if they didn't seem like improvements at the time. Remember, machined steel forgings were part of the altar at which shooters of the time worshipped, In three years Winchester would drop the M-12 because of excessive manufacturing cost, and replace it with the M-1200 and its aluminum-receiver. A storm of outrage would descend upon their heads from shooters who were not ready to accept aluminum in a Winchester. Meanwhile, Mossbergs kept selling.



The Mossberg 500 is so versatile that it is even offered as a line-throwing gun for use on boats. (photo courtesy O.F. Mossberg & Sons.)



The ghost ring sights on a 590 are meant for accurate slug shooting, and durable use in a defensive shotgun. And, you can still shoot skeet with it.

The 500 receiver is an aluminum forging machined to shape. It is light, strong and rustproof. Machining aluminum is faster and less wearing on the cutting tools than is machining steel, and you should never underestimate the appeal of a shotgun that won't rust. The lighter-weight receiver either means a lighter shotgun, or the steel parts can be made even heavier and sturdier, and stay the same in overall weight as a competitive gun.

The safety is on the top rear of the Mossberg 500 receiver, equally accessible to both right and left-handed shooters. Rather than a push button in the trigger guard, the top-mounting of the Mossberg safely makes it easy to see. With the trigger guard location of most shotguns, you have to turn it upside down to see if the shotgun is on “safe” or “fire.” Not so the Mossberg.

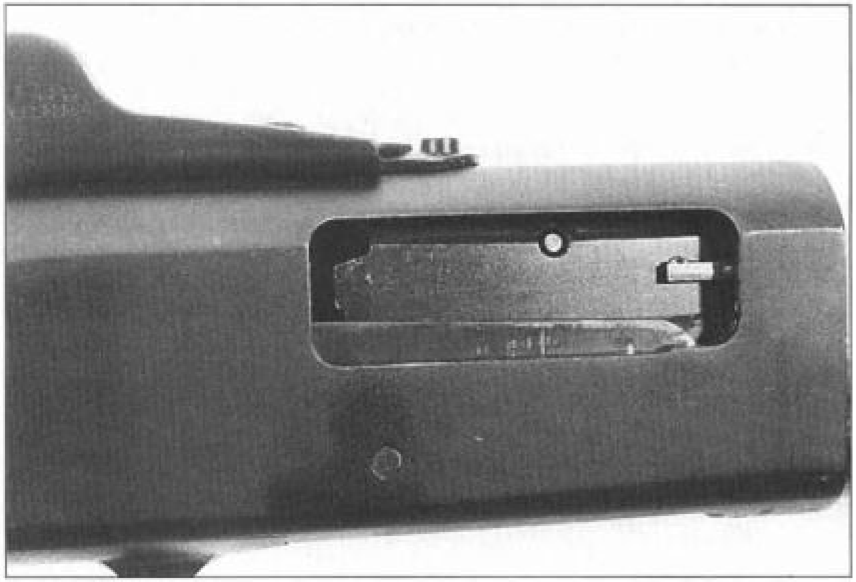
The magazine tube is screwed into the receiver, instead of being pressed or brazed to the receiver. A damaged magazine tube on the 500 can be easily replaced. If your Remington or Ithaca magazine tubes suffer damage and need replacing, the only place you can send it is the factory. As for the magazine of a Winchester Model 12, not only was it far more expensive to manufacture, but it was prone to wear. If it ever became damaged, the cost

to have it repaired was and still is high. Magazine tubes have thinner walls than barrels, and can be more easily dented or bent.

The ejector on the 500 is a large sheet of spring steel secured to the inside of the receiver with a large flat-headed screw. If the 500 ejector breaks or wears, you remove the screw and replace the ejector. (I've never seen an ejector screw come out of its own accord.) On a Remington, replacing the ejector means drilling out a rivet and replacing the ejector and rivet. In defense of the Winchester or Ithaca, I have never seen an ejector in need of replacement. The Mossberg 500 shell stops do not have to be timed to the action rails, but are simply drop-in parts. They do not even have to be staked or otherwise secured in place. The trigger assembly holds them in, and you don't have to do any more work than make sure you get them installed on the correct side.

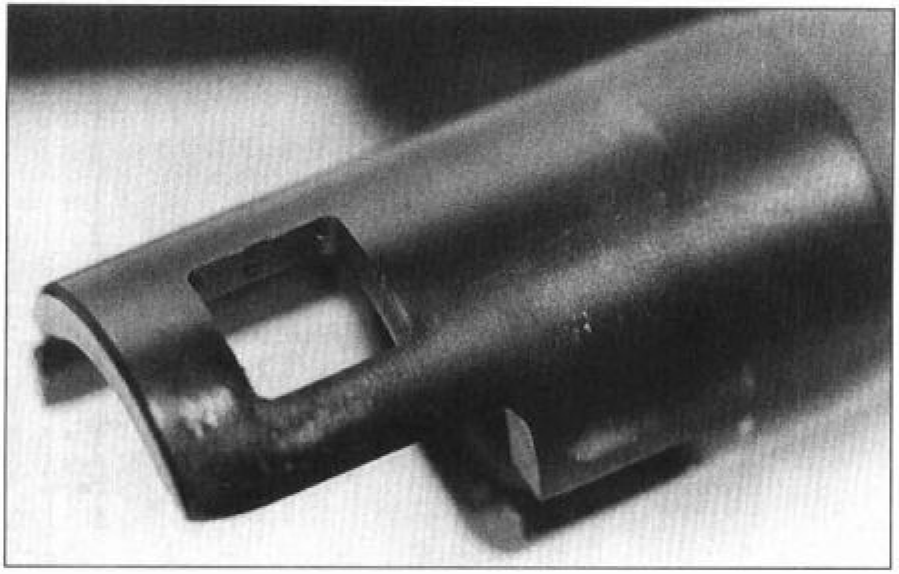
The cartridge lifter of the Mossberg rests against the bottom of the bolt slide when the bolt is closed. As a result you do not have to push the lifter out of the way to load the magazine. Unlike the Remington 870, it is impossible to double-load the Mossberg. A shell being loaded that does not catch on the shell stops, drops out of the Mossberg action rather than double feed and wedge between the lifter and bolt slide as on the 870.

The design of the Mossberg 500 is close to that of the old High Standard shotguns. The parts are not interchangeable, but some aspects of the design are so similar you would think that someone was stealing test answers from someone else. Or that the design engineers of both companies ate lunch at the same place and drew notes on the tablecloth while eating.



***The 500 receiver is an aluminum forging that is machined into a light and durable receiver*.**

The Mossberg is perhaps the easiest shotgun to work on, which is good, because it is the one most likely to need repairs. Do not react with horror at that statement if you have a Mossberg. The Mossberg was by far the most frequently-encountered shotgun at my shop. I saw them at one time or another with everything broken on them. The high breakage rate was not because there was anything wrong with it, but because Mossberg has made so many of them. And, because the Mossberg is viewed by many owners as a tool, and gets treated the same as an automobile jack or other tool. When it wasn't needed, it languished in a truck, closet, garage or gun case. When it was needed, it got used like any other tool. And some people are so hard on their tools. If you have any doubts about how tough the Mossberg is, the fact that it is the only shotgun to pass the Mil Spec tests on shotgun durability should dispel those doubts.



The 500 barrel provides the locking surface for the bolt, and takes the stress. The receiver only has to keep the parts aligned.

Part of MIL-S-3443D calls for sample shotguns to fire 3,000 rounds with a malfunction rate not to exceed 0.1%. (Three rounds!) In addition, reliability of function under extreme climate conditions is tested, and exposure to common chemicals and solvents. You may wonder why the military tests firearms with solvents like JP-4 jet fuel and hydraulic fluid. If it is all there is, and a soldier has to clean his firearm, it had better not dissolve when cleaned with JP-4 and lubricated with hydraulic fluid. War is not neat, and supply is sometimes uncertain. Then there are the mud tests, the dust tests, the freeze-it-to-the-Arctic tests…

The ultimate broken Mossberg story came into the shop one day with the owner looking for minor repairs. I call it the “duct-tape shotgun” because so much of it was covered in tape to hold it together. The bead was broken off, and he wanted a new one installed. I told him I wasn't going to repair the bead and leave the rest of the shotgun such a mess. Besides the bead, the stock was cracked and the recoil pad was loose, (repaired with duct tape) the forearm wood had cracked and fallen off. (duct tape as a cushion) the forearm had detached from the action bar, (wire and duct tape) the trigger housing tabs had broken off, (more wire and duct tape) and the safety button had broken, so a small piece of duct tape kept the remaining safety parts from rattling around and getting in the way. It needed a new safety,

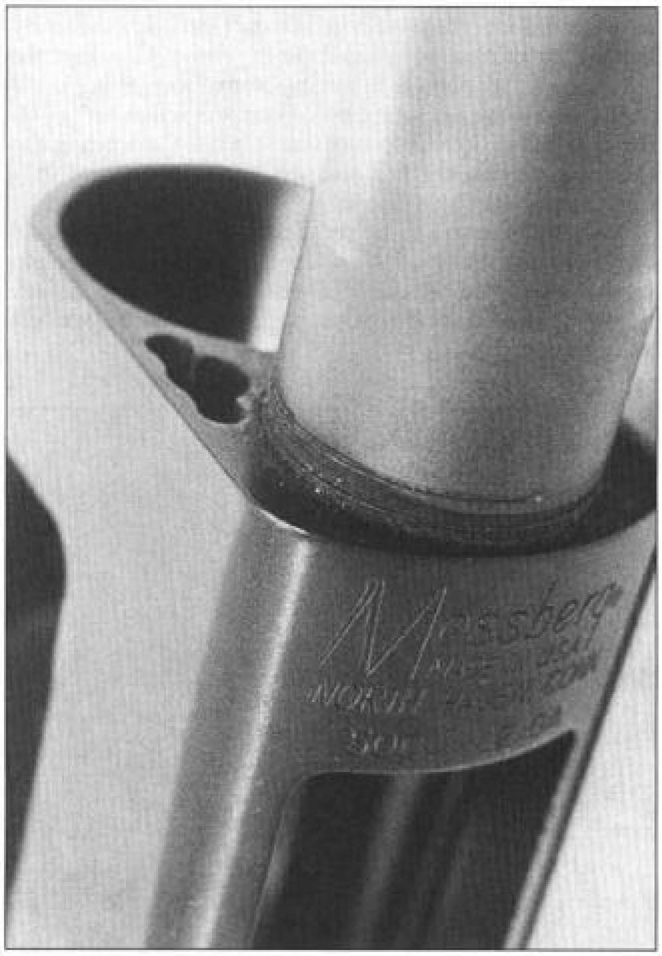
new wood, the action bar re-soldered to the action tube, and a new bead. Considering the treatment the exterior had received, the bore was probably rusty, but we didn't get that far.

Rather than repair it, he bought another. I bought the old one from him and used it as a practice and demonstration sample. (It turned out the bore was rusty after all.) All the things that were wrong with his shotgun (and more) we will fix in this chapter.

The 500 safety is on the top rear of the receiver.

***Right or left-handed, all a shooter has to do is use a thumb to move the Mossberg safety*.**

Disassembly of the Mossberg is as easy as falling off a log. Check to make sure it isn't loaded. Open the action and leave the bolt back. Unscrew the nut under the barrel and pull the barrel forward off the receiver. The nut has a capture clip that keeps it attached to the barrel. Ease the forearm and thus the bolt forward. On the side of the receiver above the trigger guard is a small pin. The small pin is the trigger housing retention pin. The larger pin-looking object above the trigger housing pin is the pivot point of the lifter. Press the trigger housing pin out from either side. Pull the rear of the trigger housing down, and then slide the front end of it out of the slot it rests in.



The magazine tube of the 500 is threaded into the receiver.

The shell stops should drop out onto the bench. The trigger housing holds them in place, without staking, screws or pins.

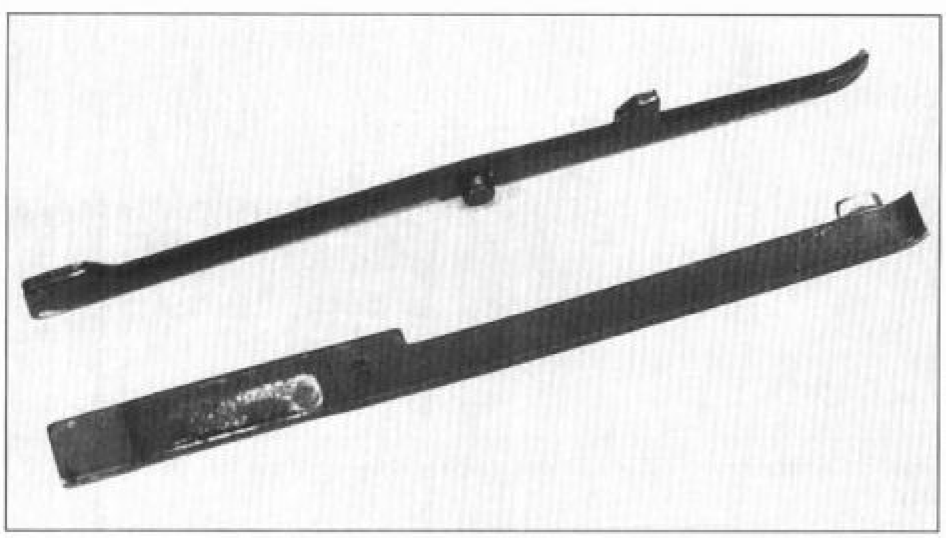
Retract the action until the bolt slide lines up with the rectangular slot cut through the rails in the receiver. Pick the slide out of the receiver. Push the bolt forward out of the receiver, or lift it out in the same path as the slide. Pushing is easier. The forearm will not come off the receiver. The magazine tube has a ring soldered around it that keeps the forearm in place. Older Mossbergs only had the ring, but decades ago the design had a spring added to it. Push the forearm forward and see if it springs back when you let go. If it does, there is a spring inside.

Look at the lifter. Shaped somewhat like a tuning fork, it is made from a spring steel stamping. Pry the rear legs away from the inside of the receiver walls, and pull the lifter out of the receiver.

The last thing that might have to come off is the magazine tube. Re-install the trigger assembly to support the receiver, and clamp the receiver in a padded vise. If you have strong hands you can probably wring the tube off bare-handed. If not, then use a strap wrench to loosen it. The other method is to clamp the end of the magazine tube (500 models only, not the 590s!) in your padded vise. The tube nut will support the clamping, but if you don't pad, you'll leave vise marks on the tube. Grab the receiver with your hands and wring the tube loose. Once loose, the magazine spring and follower come loose. The receiver has a shoulder at the magazine tube opening that keeps the spring and follower retained. The stock is held on by a bolt that goes into the stock under the buttplate and screws into the rear of the receiver.

Use a screwdriver to remove the buttplate. If the stock has a recoil pad, wipe a screwdriver with a patch, damp with synthetic lubricant, and insert the screwdriver into the access slots in the pad. Unscrew the buttplate or pad. Clamp the receiver in a padded vise and use a long and large-bladed screwdriver to loosen and remove the buttstock screw.

Once apart, you can do a detailed cleaning and perform any repairs that are needed. You don't have to remove the buttstock to clean the gun or replace broken parts. You do have to remove the stock to refinish the receiver.



The Mossberg 500 shell stops are not staked in place, and you cannot confuse the two as one pivots and the other does not. If a shell stop won't fit, check to make sure you have the correct size or the correct gauge shell stop.

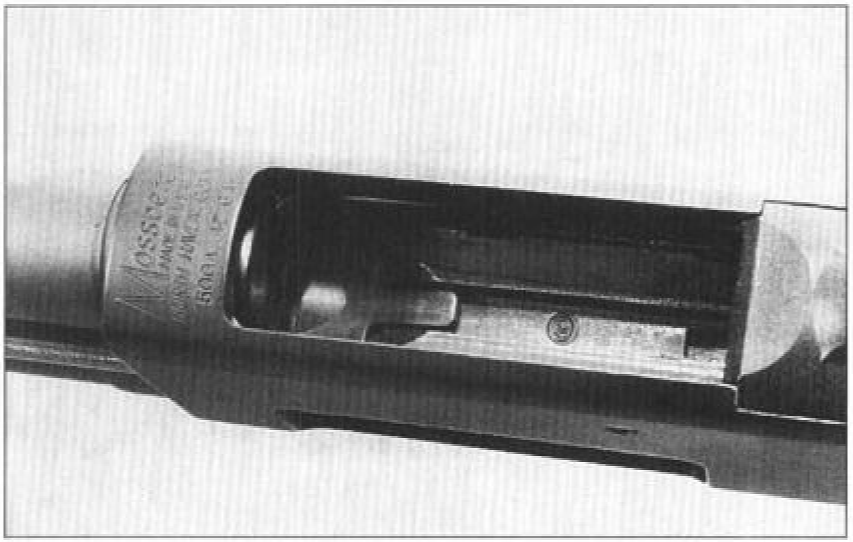
When it wears white, the Mossberg receiver can't be re-blued. The aluminum is factory-treated by a process called anodizing. Involving vats of chemicals and electricity, anodizing is not something you can do at home. If you approach a local anodizing shop, they will charge you a lot of money to anodize your worn receiver. The anodizer treats large batches of commercial parts in a vat at once. They will not risk contaminating a batch of other customers' parts with an unknown part, and will run your part all by itself. You will pay for the entire batch run. If something in your part or parts contaminates the anodizing vessel or chemicals, guess who gets to pay? Rather than spending all that money, buy one of the Brownells spray-on finishes to treat your worn pump. The last part you'll need to remove in order to spray your receiver is the safely. Removing and replacing the Mossberg safely requires some new parts. The screw that holds the safety button on is a “one-way” screw. The slot is bevelled on the removal shoulders 10 prevent its being turned out, and is often secured with a thread-locking compound. To remove the safely screw you will need to start with your hand-held grinder and a cutoff wheel. With your safety glasses, ear muffs and mask on, either cut a new slot or turn the bevel into a square shoulder on which the screwdriver can gain purchase.

The heat you generate will also break down the thread-locking compound. Remove the screw (you'll need a new one for reassembly) and the safety button, plate, ball and plunger, and the internal safety lock. All are available from Brownells.

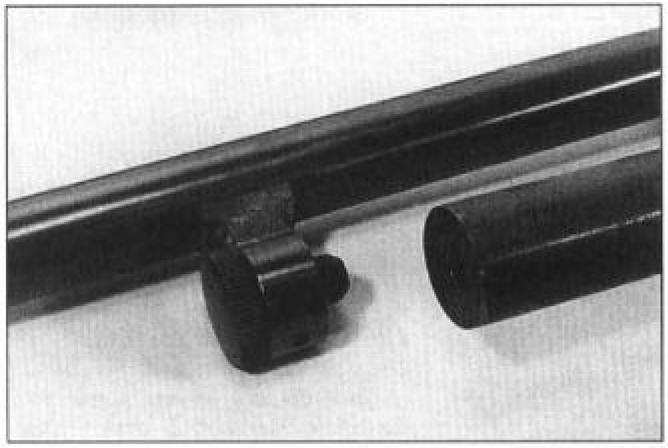
With the receiver stripped, degrease it and apply the spray-on finish as directed. Some will require baking. Chapter Ten has more.

Safety Repairs

With the action closed, the 500 lifter rests against the bottom of the bolt.



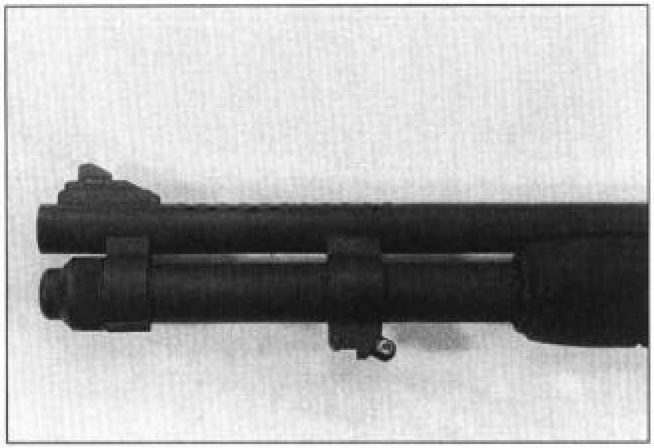
In the middle of the receiver refinishing is as good a place as any to discuss the safety repair. The safety button on the Mossberg started out as aluminum. Soon after production began, the buttons were switched to plastic. The early aluminum and the plastic buttons tend to break. Over the decades there have been several button designs, and probably different plastic formulations. The plastic parts still break. When the button breaks the safety does not operate properly. In Mossberg's defense, the location makes the life of the safety button difficult If it were in the trigger guard, it would be protected. Being on the rear top of the receiver, anything that bangs against the receiver has a shot at the button. The button is subject to abuse when you are going through heavy brush, or it can get whacked against the gunwales of a duck boat every time you get in or out. If you stand your shotgun up against your car or truck (unloaded, please!), then when it slides off and hits the ground you know the impact will be taken by the button.



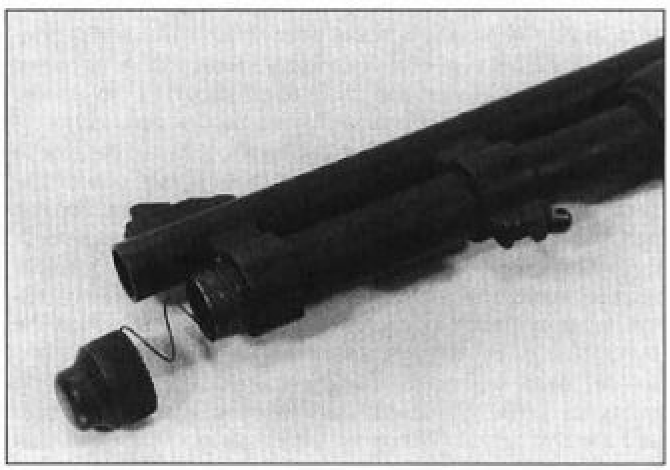
The standard 500 barrel locks into the end of the magazine tube. Unscrew the nut to start disassembly.

The safety is composed of the button, the click plate, a ball and plunger that engage the click pÃ–ate, and an internal safety lock. The internal lock blocks the trigger mechanism. The rest of the parts give you purchase to move the internal lock, and keep the external parts in place. When the button breaks, the click plate cannot support the weight of the internal lock against the pressure of the ball and plunger. With a broken button the safety can move back and forth without your knowing it. Begin your repair of the safety by deciding what to replace it with. You can use another plastic button from Mossberg, or a tougher plastic button from Brownells. A step up from plastic is aluminum. With an aluminum button you do not have to worry about breakage in the future. One option that seems sturdy is steel. A steel button will never break, but has other drawbacks. A steel button could rust. A steel button is heavier than plastic or aluminum. Just from being jostled, a steel button could shift from safe to fire or the other way around, from the inertia of the button.

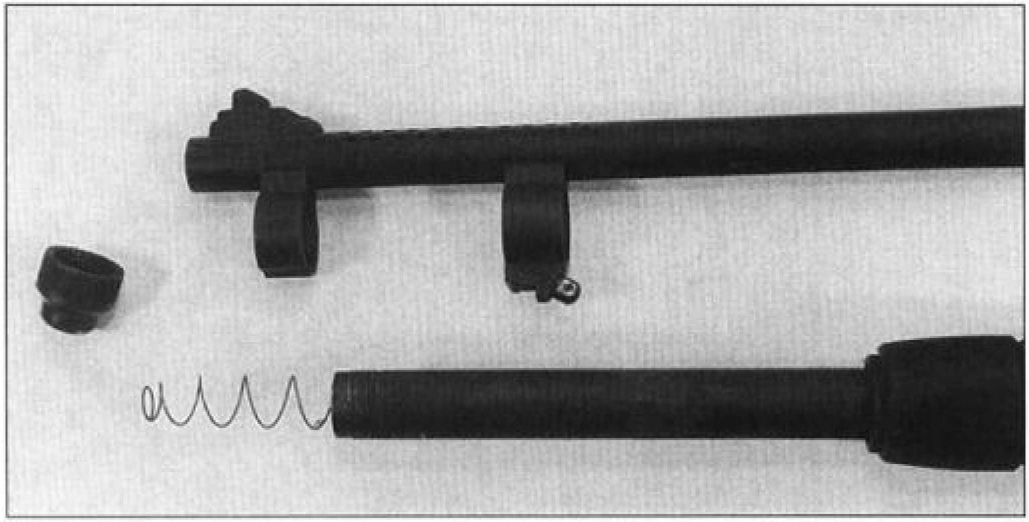
I did not think it was very likely, but I have had some customers who specifically selected aluminum or plastic instead of steel after experiencing the steel button phenomenon. Aluminum is a good compromise of toughness while staying light.



The 590 uses a different method than the 500.



Unscrew the retaining nut and the magazine spring comes out.



Pull the barrel off and the magazine parts come out without having to take the tube off.

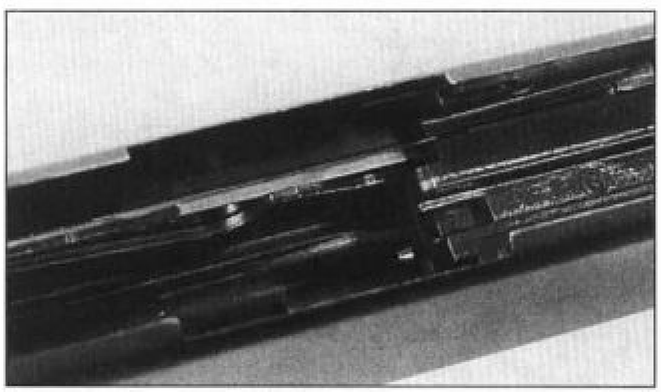
Once you have your new button selected, you must disassemble the old safety. Take off the barrel, and remove the trigger assembly and the receiver internals. Clamp the receiver in a padded vise while leaving enough room to reach into the rear of the receiver. Adjust the angle of the receiver until the safety button is level. You will have to raise the stock end of the receiver to do this. Even without the button, the safety screw is locked in place. The bevels prevent unscrewing. Use the cut-off wheel in your hand-held grinder to re-cut the slot and remove the screw. When the screw comes loose, the internal safety lock will fall. As you finish removing the screw, reach inside with your other hand and hold the lock to prevent its tailing.

The trigger assembly retaining pin is the one directly above the trigger.

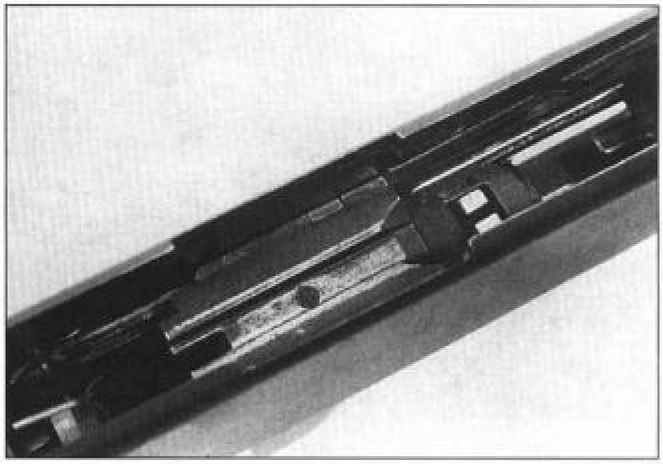
What looks like another pin are the heads of the pivot bearing for the lifter.

To start disassembly of the receiver, push the trigger pin out…

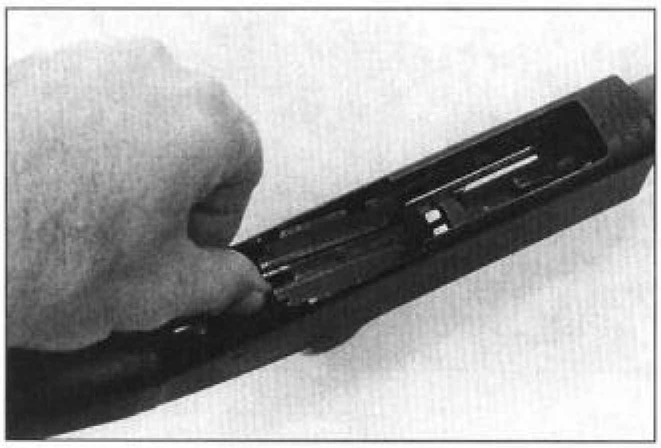
…and pivot the trigger assembly out of the receiver.



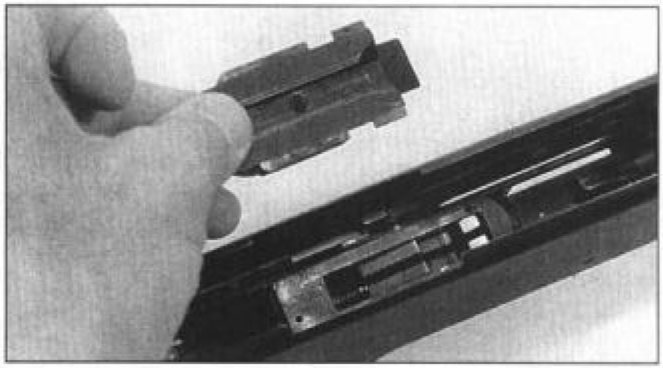
1. This is the open receiver with the bolt forward and the shell stops out.



2. Run the forearm back until the bolt slide lines up with the rectangular cut in the receiver.



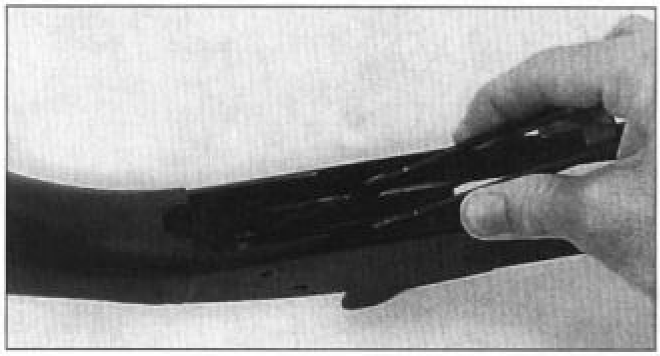
3. Then lift the bolt slide out.



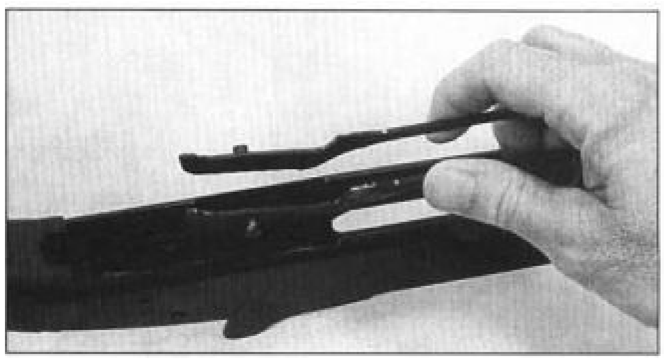
4. The 500 bolt slide is a simple casting, and does not have any springs or plungers in it.

5.. With the bolt slide out, you can run the forearm forward in a 590. On the 500, you can't take the forearm off without unscrewing the magazine tube.

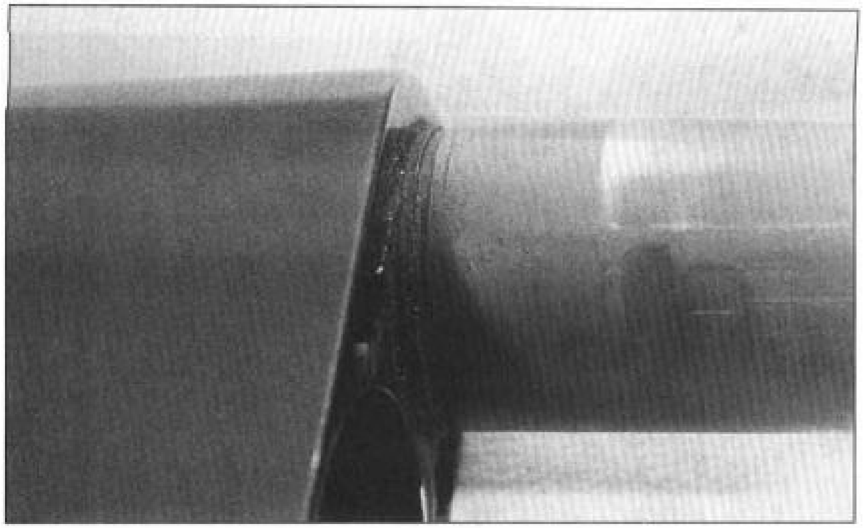
6. It is easier to push the bolt forward out of the receiver than to fish it out the same way the bolt slide came.



7. The lifter is a spring steel part, flex the legs in (with the safety ON) and lift it out.



8. Here are the relaxed legs of the lifter, showing the proper orientation.



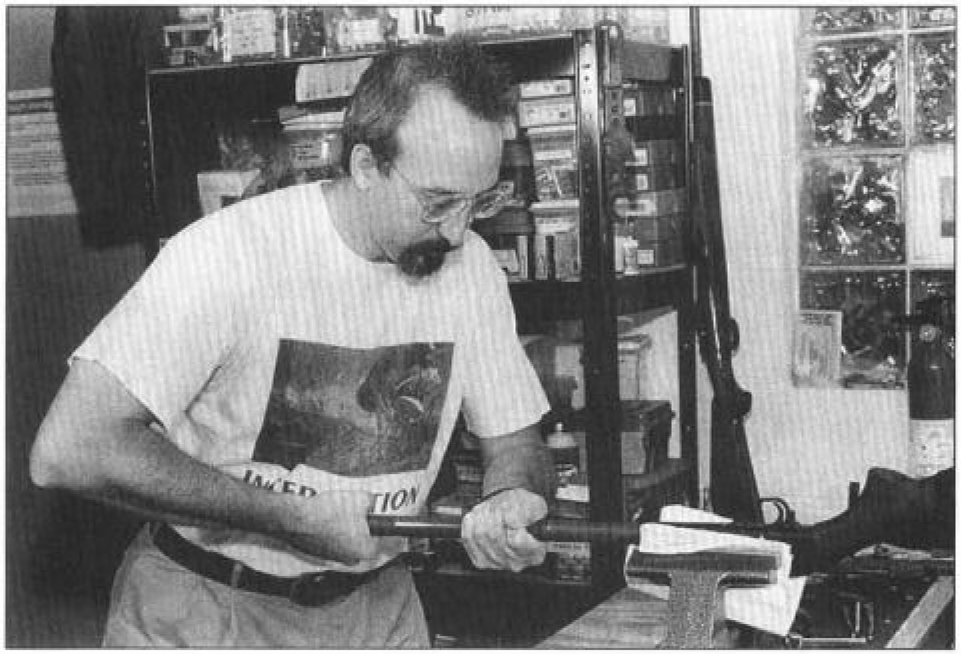
The threaded magazine tube is easy to unscrew once the receiver or tube is properly anchored.

Set the lock aside. Pull the click plate off and check the bail and plunger spring. Sometimes when the safety has been broken for a while, the ball and plunger spring can become packed with gunk. If they are, pull the spring out and clean the hole. Sometimes the ball is missing. Many times, firearms manufacturers select the best size part for the job, even if it is not an off-the-shelf industrial fastener. For once, a manufacturer used a standard industrial size, ⅛-inch ball bearings. (Three cheers for Mossberg.) Brownells carries replacement ball bearings. Use one of the ⅛-inch balls. Wipe the accumulated gunk off of the old parts. Check the new button for fit in the safety slot, and make sure the new screw fits through the hole in the button and will engage the threads of the internal lock.

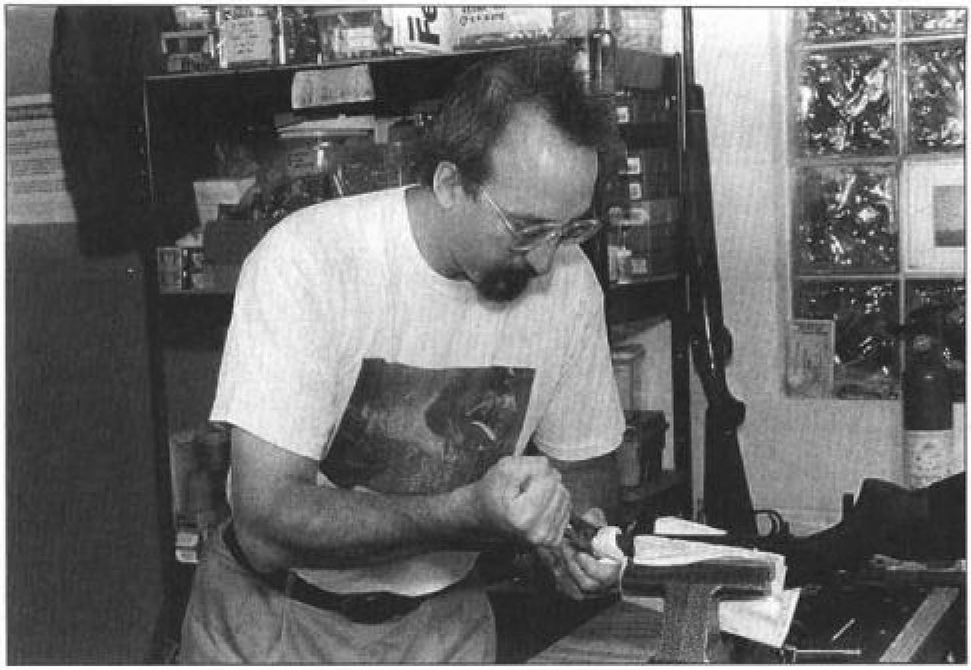
With everything checked and fitting, begin assembly. Put a drop of oil into the plunger spring shaft. Put the spring in place, and perch the ball on top of it. Place the click plate on the ball. The click plate has four holes, and its direction does not matter. Look underneath the safety button. Some buttons will only have two detents, while others have four. The four-detent buttons can fit either way, but the two-detent buttons will only work when the button is placed over the click plate with the detents to the rear. Place the safety screw through the hole in the safety. Pick up the internal lock and with your left hand, reach under the receiver and bring the lock to the safety slot. The curve of the lock goes to the rear. Pick up the button with screw and place it in the slot with the screw engaging the lock threads. Take a

screwdriver and gently turn the screw until it has caught. Once caught, lightening the screw is a matter of juggling the various safety parts to keep them properly aligned until the screw is tight.

With a strong enough grip, you can just wring the tube off.



The screw tightness determines the torce needed to move the safety. You can adjust the screw and check the movement of the safety button until it feels right. You want the safety to be tight enough that it will stay where it is put and not get bumped or jostled on or off. But you do not want to make the safety too hard to move, especially if you will be mounting a scope on the shotgun. If the safety is too difficult to move, the temptation exists to push it to “fire” once in a hunting blind, and leave it there.



You can use a strap wrench, or a padded pair of pliers.

Once you have set the screw tightness, you must check the fit of the safety. Put the trigger assembly into the receiver and press the trigger assembly pin through. With your left hand, reach up into the otherwise empty receiver with your thumb and put it in the path of the hammer. With your right hand, push the safety on and pull the trigger. The hammer should not fall. Push the safety off and pull the trigger. The hammer should fall. Use your thumb to cock the hammer and repeat. In replacing hundreds of safety buttons and other parts, the only time the safety lock did not work properly was when I had reversed the internal safety lock. If you have it backwards, remove the screw, turn the lock around and retighten.

With the operational checks done, it is time to lock the screw in place. Turn the receiver over in the padded vise and clamp it. Take some thread-locking compound and place a drop in the safety lock screw hole. Let it set for at least a few minutes, or better yet an hour. Reassemble your 500 and go have fun.

The Broken Forearm

A broken forearm falls into two camps, the wood cracks or the metal assembly comes apart. A cracked wood forearm is not much fun to shoot.

The sharp edges can be uncomfortable, and there is the constant worry of slivers. To replace the wood, you have to unscrew the retaining cap on the end. The easiest method is by using the Menck wrench from Brownells. The wrench slides over the magazine tube (after you've taken the barrel off) and the teeth in the front of the wrench engage the slots in the forearm end cap. Unscrew the cap and slide the cracked wood off. You may find the outside of the tube, under the wood, rusted. If it is rusted, scrub it off with steel wool or a wire brush. It may be a long time until the new forearm comes off, and you don't want the tube rusting even more. Once you are down to bare, clean metal, apply a spray-on finish. If you take the forearm off and the tube is not rusted, apply a coat of paste wax. The wax will make installing the new forearm easier, and slow down or prevent future rust.

The 500 stock is held on by a bolt through the rear, covered by the recoil pad. A synthetic stock is more durable than wood, but can't be shortened.

Things to watch out for: Make sure the new forearm fits over the action tube. If it is too tight a fit, you will have to sand the interior of the new forearm until it fits. The new forearm may also be a bit longer than the old one. If so, the end cap of the action tube may not tighten to its previous location. So long as it holds the new forearm in place and clears the barrel, you are set. If it does not, you will have to sand or file the end of the forearm until the end cap will turn enough to properly orient. A synthetic forearm will not crack if heavily-flexed, to wrestle it onto the forearm tube.

However, it may still have to be filed to adjust for the correct fit of the end cap. Slide the cap back on and catch the threads, then tighten with the wrench.

How can the aluminum receiver of the Mossberg stand the shock of firing? By not taking it. Unlike many of its contemporary competitive designs, the Mossberg bolt did not lock into the receiver to fire. Rather, it locked into an extension of the barrel. Much of the cost of the Winchester M-12 and the Ithaca M-37 came from the need to precisely machine the receiver from a block of steel. The receiver has to be steel, because the bolt locks to the receiver when closed. The bolt had to be machined to a precise length. The locking recess in the receiver has to be machined to an exact location. The receiver walls have to be thick enough to take the load. On the Winchester '97, the carrier is also the locking block. The carrier, its pivot pin, and the receiver where the pin rests have to be strong enough to take the load.

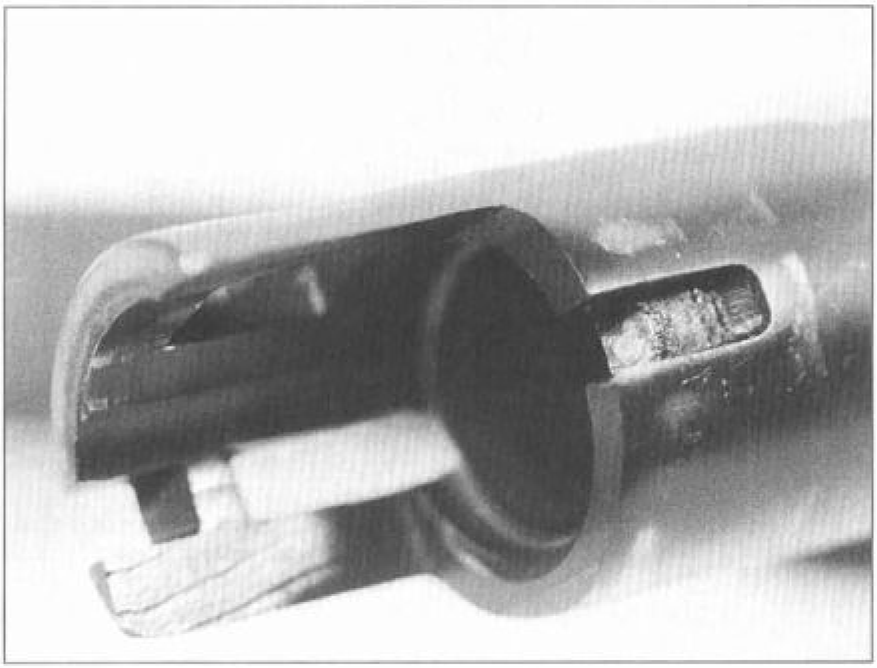
On the Mossberg 500, the bolt locks into an extension fastened to the barrel. The critical dimensions are the distance from the locking recess to the chamber, and the distance from the locking block in the bolt and the bolt face. Both are easily measured (in the factory) and kept to a precise figure.

The aluminum receiver only acts as a cover and guide to the moving parts, and does not have to take any of the forces of firing except to transmit the force of recoil to the shooter.

If this was such a great idea, why did it wait until 1961 to come about? It didn't. The locking mechanism is the same method used by John Moses Browning in the A-5. Browning also used it in a number of different pump actions he designed.

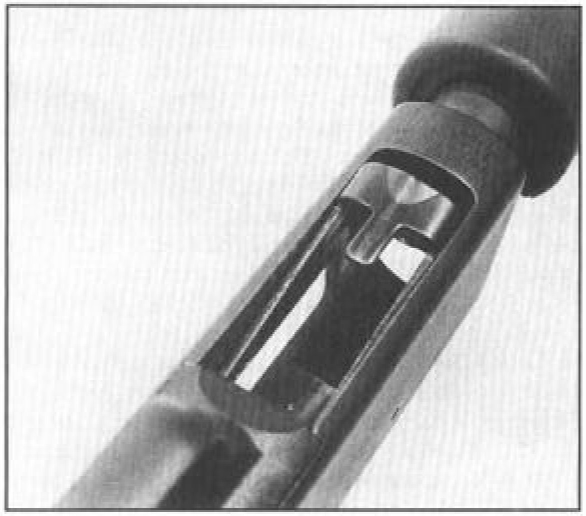
So why didn't other manufacturers use it? Browning had the patents. By the time the patents had expired, many manufacturers had been making their models for years or decades. The customers expected a particular design, the tooling was paid For, and the cost and risk of switching was high. Remington switched to the barrel extension in 1950 with the 870, and pulled it off. Winchester switched in 1964 with the 1200 and almost foundered. Their customers were not ready to have an icon of beauty and

shotgun shooting like the Model 12 replaced with an industrial tool like the 1200.

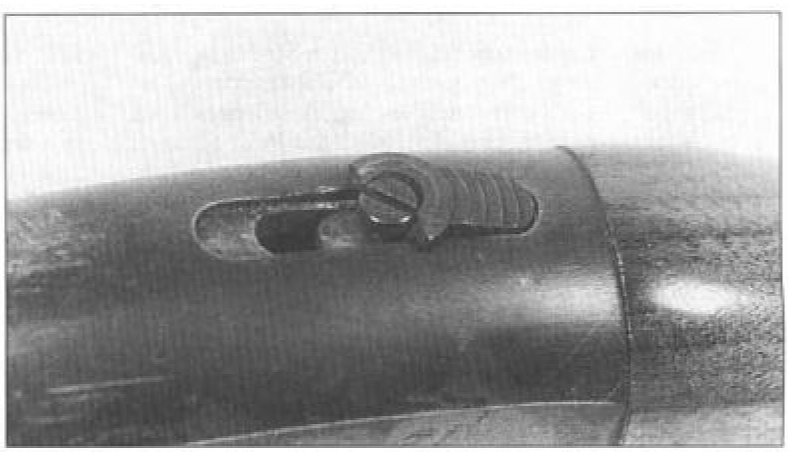


This photo of the breech of the 500 shows the slots for the dual extractors.

Mossberg didn't have to worry about the patents, they had long expired. As the new guy on the block (as far as a pump was concerned) they wouldn't have to deal with the manufacturing inertia of paid-for tooling, nor with an established customer base with traditional expectations.



The aluminum receiver of the 500 only needs to keep the parts herded together, as it doesn't take any of the stress of firing directly.

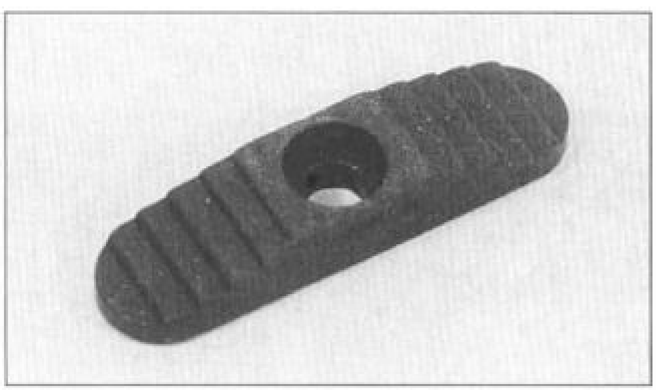


A broken 500 safety. Being on top of the receiver puts it in line of a lot of impacts.

The serious breakage of the forearm is when the tube the wood rides on become detached from the action bar and collar. I have only seen this

happen on the older, single-bar actions. The Mossberg 500 started out using a single action bar. In 1969, Mossberg switched to the double action bars for the Model 500AA. The next year all production of the 500 used the double-bar design. While I have only seen singlebar shotguns suffer tube separation, the repair process would be the same for a dual-bar forearm if it were to become separated.

To repair the tube you will need to disassemble the forearm, and have on hand a propane torch, wire brush or abrasive cloth, degreasing solvent and Brownells 80PA Silver Braze solder paste. Take the forearm off the tube, and remove the action bar from the receiver. If you look at the end of the tube you will see the spot weld where the tube and action bar collar were connected. The weld broke loose and the two came apart. Use the wire brush or abrasive cloth to clean the end of the tube down to bare metal. For the inside of the collar, use Brownells fine-wire small circular wire brush chucked in your hand-held grinder. You must get the surface clean of rust, dirt and bluing. Once clean, degrease the surfaces. Check the fit. The tube will probably not go back into the collar simply pressing it by hand. If it is tight, good. If you can press the tube in and pull it out with only moderate force, you need to bell the end of the tube. Without a bit of friction fit, the unsupported solder will have to take the full brunt of the action forces. And, a friction fit keeps things in place while you solder.



This is a replacement safety button.

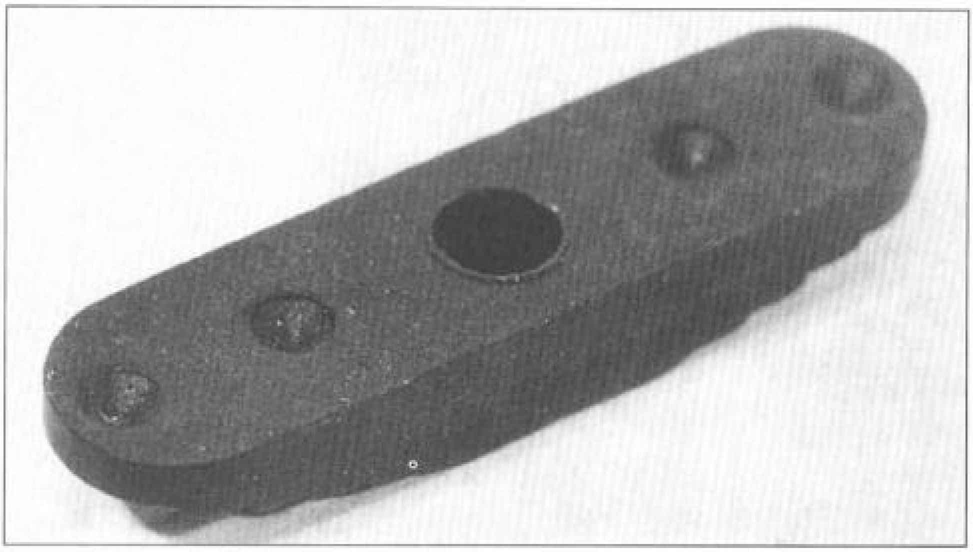
The Brownells 80PA is a silver solder and its flux mixed into a paste. The solder is squeezed out of the tube onto the location you want soldered. As a silver solder, it requires 1,200-degree heat to melt to bonding, but for that

effort you get a bond that has an 85,000 pound shear strength. Properly cleaned and heated, the two parts of the forearm will be better secured than when they left the Mossberg factory in the 1950s or 60s. Place a ribbon of the solder paste around the leading edge of the end of the tube. Use a clean dry piece of wood to smear the solder and its flux around the tube, as high as it bears against the collar. The solder will go where the flux is, so you want an even and complete application. Clamp the action bar of the assembly in your vise with the collar resting on the top of the jaws. Line the spot weld of the tube and collar up with each other, and press the tube in place. Put a piece of wood on the tube and tap it with a hammer to make sure the tube is fully bottomed out. Loosen the vise and lift the action bar a couple of inches and re-clamp the vise. You used the vise for support to press the tube in, but if the collar stays in contact with the vise, the vise jaws will suck the heat out faster than you can apply it. You would never get to 1,200 degrees.

For insurance, add a small bead of solder/paste mix around the edge of the joint.

Light your propane torch or torches and heat the collar and bottom of the tube to a cherry red color. Apply your heat to the collar, and let conduction carry the heat to the tube. Heat from below, to pull the solder into the joint from the bead you applied just before heating. Let them cool. Once cool, clean the outside of the collar with steel wool and apply cold blue to touch up the surface. Reassemble the forearm and then install it in the shotgun.

Current production Mossbergs feature a spring-loaded lever that takes the rattle out of the forearm. Rather than fit loosely on the magazine tube, the forearm is leveled to a firm fit against the tube. If you solder such a forearm to repair it, you will take the temper from the spring, and remove the non-rattle feature of your 500. If you want to keep the non-rattle feature, you can send it back to Mossberg for repair or replacement.



***This view shows the area underneath the safety button, showing the detent click ball recesses*.**

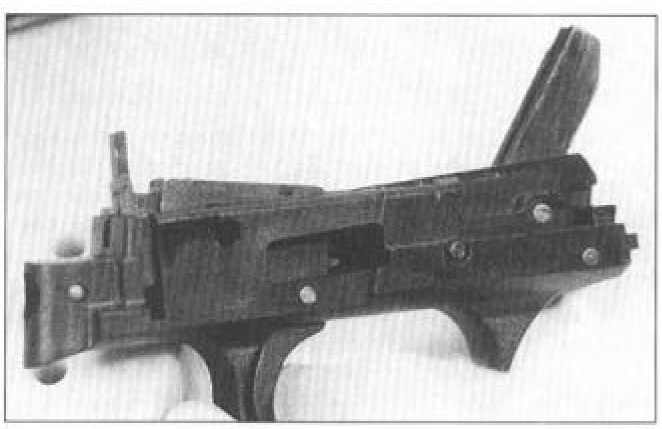
The Magazine Tube

The thin walls of the magazine tube are easily dented or bent. If the magazine tube on a pump or semi-auto shotgun becomes bent or dented, it will not feed properly. To lift the dent on the Mossberg, you have to remove the magazine tube from the shotgun. Check to make sure it is not loaded. Remove the barrel and clamp the receiver in a padded vise. Unscrew the magazine tube. Set the magazine spring and follower aside, and remove the receiver from the vise. Clamp the magazine tube in the padded vise, clamping only on the very muzzle end, where the internal barrel nut will prevent your crushing the tube. Put a bore brush on your cleaning rod. A used brush will do. Wrap a cleaning patch around the brush and swab out the magazine. Once the inside of the magazine is clean, run a patch that has been lightly oiled down the tube.

To raise the dent in the magazine tube, you must have either the hydraulic dent raiser or a magazine tube mandrel. If you are using the hydraulic barrel dent raiser, the magazine tube is larger in diameter than the barrel the mechanism was designed for, and you must bridge the gap. To raise the dent you'll need to have a backer. I made a backer for my hydraulic lifter out of a piece of scrap barrel. If you do not have a barrel to cut up, you can get a section of brass plate from Brownells and hammer it into a curve that

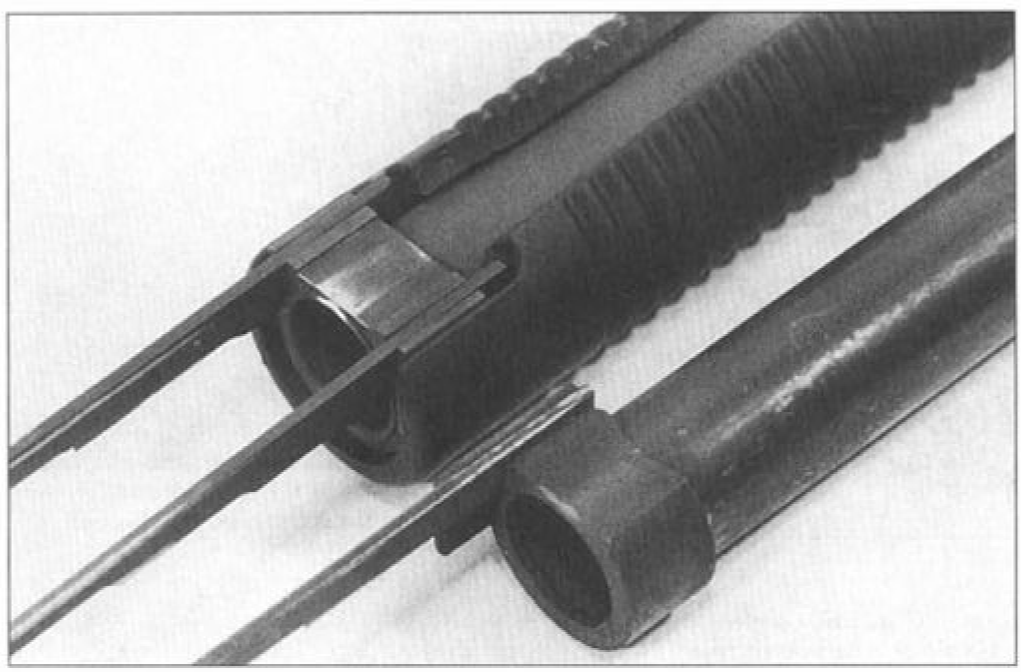
matches the inside of the magazine tube. Once fashioned, use a piece of masking tape to secure the backer to the hydraulic lifter head. Then lift the dent in the magazine tube as you would lift the dent in a barrel. The magazine lube is much thinner than the barrel, so you will not need as much force to lift a dent. If you are too heavy-handed you will over-lift the dent and slightly oval the tube. If you oval the tube, you'll be able to tell because the shells or follower won't pass the previously dented spot, even though the dent is gone. To repair the oval, re-insert the lifter, but turned ninety degrees to the direction you used it before, and gently expand the sides of the magazine tube.

The stub sticking up is the safety leg, and it pivots up with the trigger when you pull the trigger.



The leg goes up when you pull the trigger, and the safety blocks the leg when it is ON.

The other dent-lifting tool is a magazine tube mandrel. If you have a lathe and the time, you can make your own mandrel. The mandrel is simply a bar turned to the intended inner diameter of the magazine tube. It is also tapered on the leading edge. With the magazine tube clamped in the padded vise, insert the mandrel into the magazine tube. Use a rod and a hammer to drive the mandrel over the dent. Once the mandrel has lifted the dent, step to the other end and insert your rod through the opening in the barrel nut and drive the mandrel back out of the magazine. If you must go the mandrel route, even if you have a lathe, it is easier to go the Brownells route.

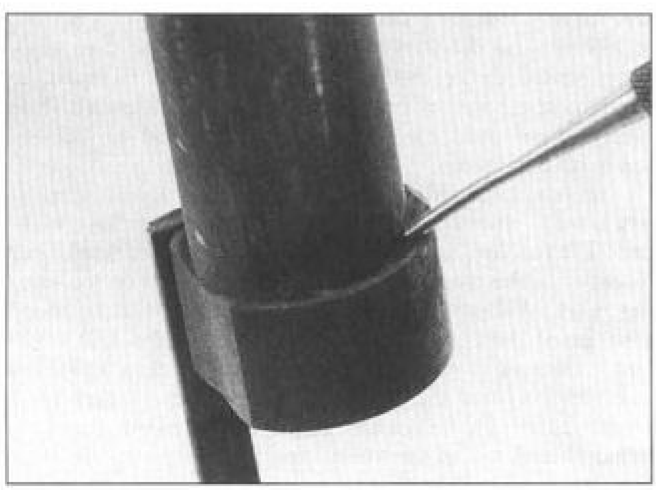


Only rarely does the forearm separate from the bars, and then only on the single-bar models.

In all the talk and work to lift the dent in a magazine tube, you should not overlook an easier way to fix your problem. Replace the tube. A new tube is cheaper than either the hydraulic dent lifter or the mandrel. If you already have those tools on hand, repairing the current magazine tube is only a matter of time. But spending $200 for the tool to repair a $20 part is not good economics unless you will be repairing a number of dented parts.

To replace a dented tube with a straight one, contact Jack First or Gun Parts Co. to find a good clean used tube, or have Brownells ship you a brand new one. As of this writing, a new tube from Brownells will cost $20,77 plus packing and shipping.

Repaired or replaced, installing the tube takes both hands. Take the tube out of the vise and clamp the receiver in your padded vise again, with the trigger assembly installed for support. Clamp it upside down, with the buttstock pointing away from you. Put the magazine spring in the magazine, and the follower in the magazine tube opening in the receiver. Line up the spring with the opening and the follower and press the tube to the receiver, compressing the spring. Reach around with one hand and press the follower back into the magazine tube. Turn the magazine tube to catch the threads. Now, while holding the follower into the end of the magazine tube, screw the tube into the receiver. Once the tube stops, check the function of the follower. Press it into the magazine tube and let go. Does the follower move freely? If not, you have trapped the follower between the tube and receiver. Loosen the tube slightly and press the follower back into the tube. Again, tighten the tube into the receiver. Once the tube is tight and the follower moves freely, grasp the end of the magazine tube with both hands and tighten the tube with moderate force. You don't have to make the tube wrench-tight, and you certainly don't need a thread-locking compound.



This is the joint which you must re-solder if it comes apart.

Once the barrel is installed, the magazine tube can't move. Once a year you should check to make sure the magazine tube hasn't come loose. If it has (highly unlikely) simply clamp the receiver in your padded vise and retighten the tube.

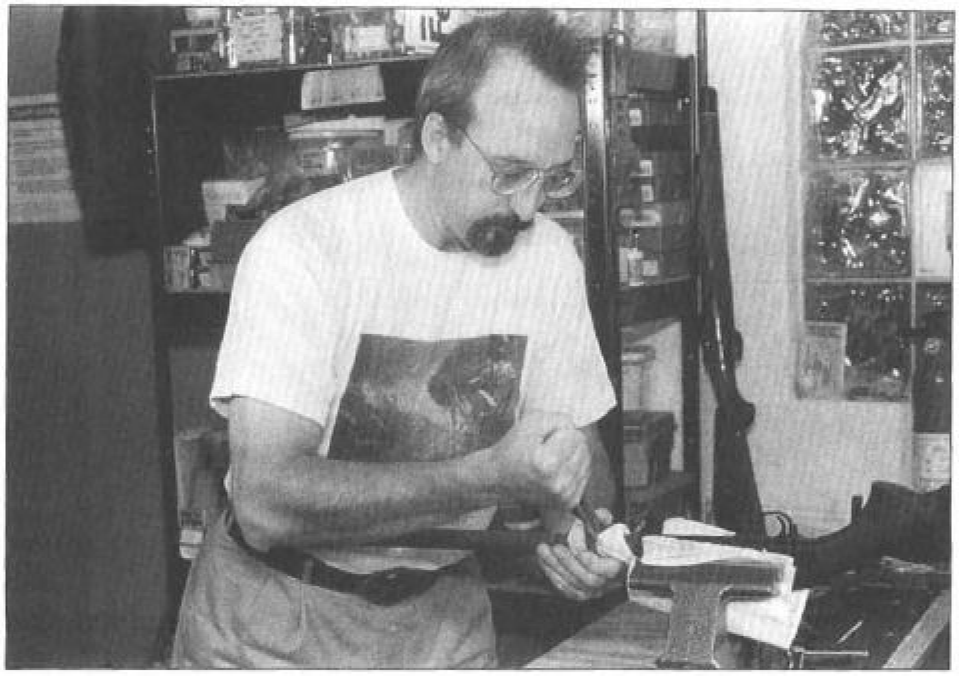
The removable magazine tube, secured at the end by the barrel hanger, makes the Mossberg easy to work on, and simple to replace a damaged tube. It makes turning a Mossberg into a defensive shotgun more difficult. If you have a five-shot Remington 870 and you want to make it an eight-shot shotgun, you only have to install a magazine tube extension and a longer spring. To do the same to a Mossberg you have to replace the magazine tube with a longer one, and buy a barrel to match. Since the barrel locks into the end of the magazine tube, a longer tube requires a barrel with the hanger farther from the receiver. To go from five to eight rounds on a Mossberg costs more than on other shotguns.

If you have a spare Model 500 that you want upgraded, you can send it to Mossberg and they will replace the parts for you. They will not, however, install a set of ghost ring sights for you. For that, you're on your own.

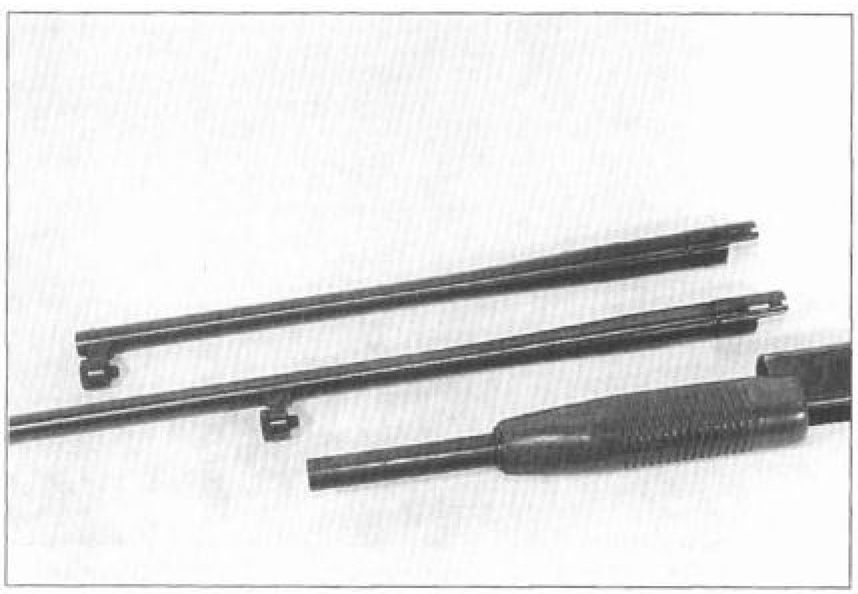
The Trigger Housing

The Mossberg trigger housing is held into the receiver by the trigger housing pin in the rear, and by two tabs that rest in notches in the receiver at the front. Early Mossberg 500s had trigger housing frames that were made of aluminum. (As did the design clone, the High Standard.) Early in production the trigger assembly housing was changed to a plastic injection molding. The plastic is as tough as Mossberg can make it, but it isn't indestructible. If you whack the trigger housing against something like the railing of a duck boat or duck blind, especially when it is cold (shoot ducks and geese in the bitter cold, who does that?) the plastic can break. With the front tabs broken off, the trigger housing does not sit properly in the receiver. The slide lock does not line up with the slide, and the safety lock does not line up with the safety tail. As with the magazine tube, you can repair it or replace it. Repairing it involves milling or drilling the front of the trigger housing to insert steel plates or rods to replace the broken tabs. If you decide not to go through the hassle (a wise choice) of the drilling and milling, and subsequent fitting, do not just buy an empty housing. Yes, it is a tempting thought to buy the plastic and swap the parts. I did it once. After struggling and cursing, (and deciding that if I ever got a tour of the

Mossberg plant I would pay particular attention to the trigger assembly station) I quit.

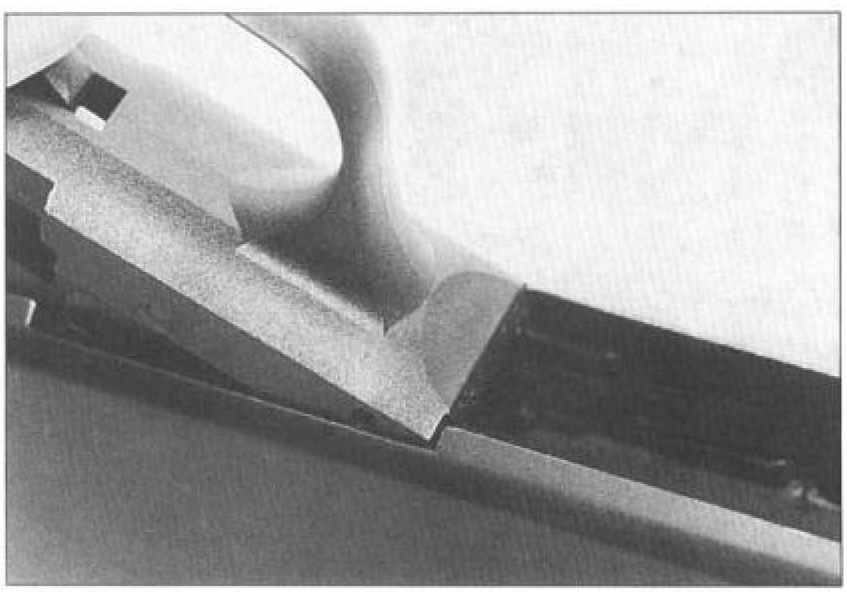


if you have a dented magazine tube on a 500, you must remove it in order to use the magazine tube mandrel.



***Because of the attachment method, you can't simply add a magazine extension tube to a Mossberg. But you can send yours in to have a new tube and barrel fitted*.**

Box up your trigger assembly along with the rest of the gun, enclose a note with your return address so they can send you a new one, and send it back to Mossberg. For a number of years before I gave up commercial gunsmithing I did not repair any Mossberg trigger housings, I simply sent them back for replacement. Mossberg would send me a replacement in a couple of weeks at no charge. When the first one came back at “no charge” I pawed through my parts drawers for other busted old trigger housings. I was a terrible pack rat back then, and I actually had a drawer full of broken Mossberg trigger housings! I sent them all in, and received free replacements. Since then, Mossberg has decided they need the whole shotgun, (probably because of guys like me). Even if Mossberg charges you for the replacement, it is worth it to avoid assembling the trigger mechanism into a new housing. Without the special assembly tools and fixtures, getting the trigger parts into the housing is a knuckle-busting experience.

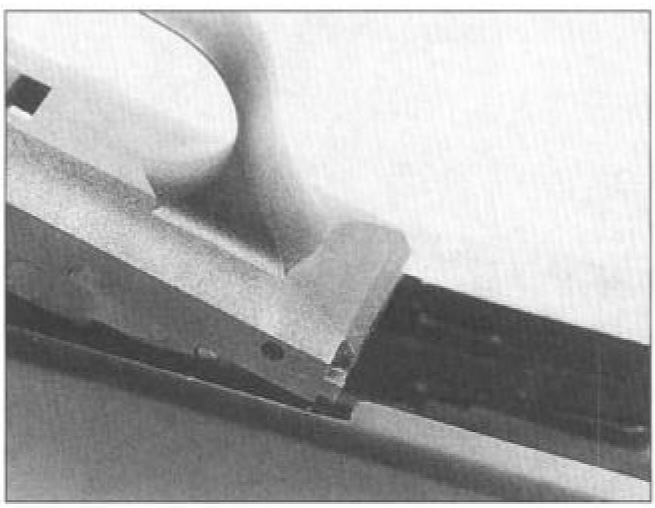


***The trigger assembly pivots into the receiver at the front*.**

Mossberg has taken such care in keeping the dimensions within specs through the years that I have never had a trigger housing that did not simply fit in place, and work as designed.

The ejector on the Mossberg 500 is a large flat spring steel part that rests inside the receiver. It is secured to the receiver wall by a large flat-headed screw. While the ejector rarely breaks, it can become worn down through continual use until the empties are not flung out with the desired enthusiasm. You might ask how can a spring steel part become worn down by banging against a brass part, the shell rims? Simple, the rims aren't brass. They are brass-plated steel. And the ejector wears from rubbing against the bolt. The flex of the ejector keeps it pressed firmly against the bolt, and the bolt cycles back and forth each time you work the action. The mystery is not that the ejector wears, but that it lasts so long.

Replacing the ejector is simple but not easy. The ejector screw is held in place with thread-locking compound. To remove the screw you will need a large screwdriver that properly fits the screw slot.



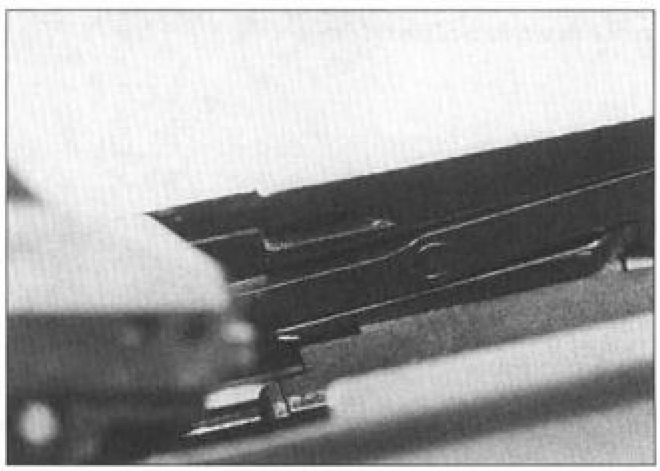
The corners of the trigger assembly catch into…

To remove the screw, disassemble the shotgun. Place the receiver on your bench with a pad or several layers of cloth underneath it. Position the magazine tube so it rests against something vertical like the vise or a post, to keep the receiver from moving when you loosen the screw. Insert the screwdriver through the ejector port and into the screw slot. Bear down on

the screw and receiver, and turn the screw loose. You may have to use a wrench on the shaft of the screwdriver to gain enough leverage.

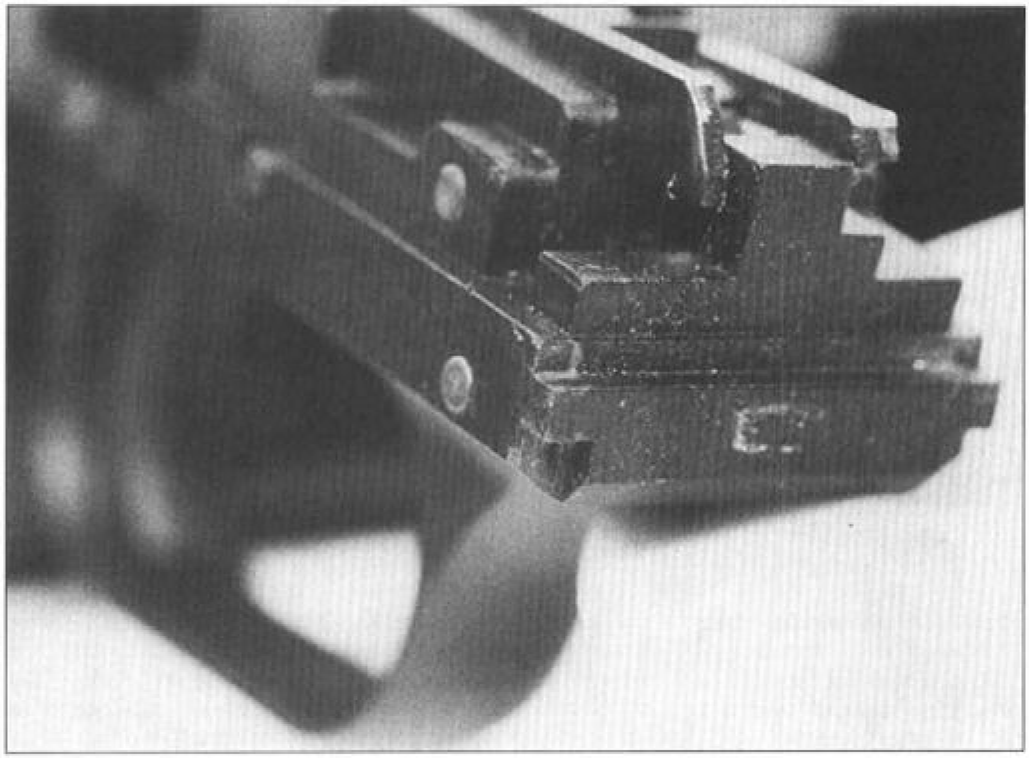
Once the screw is loose, it is a simple matter to turn the screw out, remove the old ejector, insert the new ejector and tighten the screw. The ejector leads a hard life. It is subject to all the shocks of the receiver when firing, it gets powder residue all over it, and men gets soaked with cleaning solvent. Anything that goes into the receiver bangs against the ejector. Once you have checked the function of the new ejector and found it proper, loosen the screw, apply a drop of thread-locking compound from the outside, and then tighten the screw.

Stock Repairs



…slots cut into the receiver

The Mossberg stock suffers from the same cracks as any other shotgun stock. I'm not sure if it is the wood, or the use, but considering the number of Mossberg shotguns out there, and the number of other repairs I had to make, I saw relatively fewer Mossberg stocks needing repair. However, a Mossberg stock will probably cost you less, used, at a gun show. (Again, there are so many.) A Mossberg stock as a replacement or a practice stock is a good investment.



When the trigger housing breaks, these little tabs get sheared off. Send the gun in and Mossberg will replace it.

On either the original or the practice stock, you can improve your gunsmithing skills by installing a sling swivel stud, a recoil pad or repairing cracks. It may seem sacrilegious, but with an inexpensive practice stock, you can even deliberately crack it and then repair the crack.

Unlike the all-steel and intricate trigger assembly of the Browning A-5, the Mossberg is a plastic housing with simple parts. Simple means inexpensive, and plastic in this case means more than durable enough.

If you want to forestall the possibility of cracks, then swap the wooden one for a synthetic.

Speaking of Ribs

The Mossberg rib may seem loose. I have had a few shooters bring their Mossberg 500s in complaining that the rib was loose, and asking if I could fix it?

The Mossberg rib is attached to the barrel at the rear with a cross pin. Along the length of the rib it is attached to each post by fitting into grooves cut into the tops of the posts. The rib has a channel underneath, and rides on top of the posts, secured by its two flanges riding in the grooves of the posts.

When a Mossberg barrel expands or contracts from the heat or cold, the rib is free to slide along the posts. Rather than being slightly bent from the rib expanding or contracting at a different rate, the Mossberg barrel is free.

I'm not sure how much difference it makes, but it is a neat idea. However, when the rib is so loose it rattles and becomes annoying, something has to be done. That something is simple. You'll need a drift punch, hammer and a hard, non-marring block. Take the barrel off of the receiver and lay it on your bench. Place the backing block underneath the rib at the midway point, at a post. Press your drift punch against the opposite side of the rib so the rib is pinched between the drift punch and the backing block, right at a post. With your hammer, give the punch a moderate tap, just enough to peen the edge of the rib slightly tighter to the post. Shift the backing block to the muzzle, and repeat the process at the forward post of the barrel.

Check the rib by grasping it and seeing if you can rattle it. You want to tighten the rib enough to diminish or remove the rattle, but you do not want to mash the edge of the rib tight to the post. A mashed rib is unsightly, and will not slide to accommodate expansion and contraction when the temperature changes.

Bead Repair

Repairing or replacing a bead on a Mossberg rib is like that of any other shotgun, except for the expansion-joint design of the Mossberg rib. You should install the new/replacement bead in the rib itself, and not place the bead so it goes through the rib and into a post. Ditto if you are installing a mid-rib bead.

Tube reaming/threading

Mossberg barrels are everywhere. While their ubiquity and low cost make them perfect candidates as practice barrel, these attributes also mean it is simple and inexpensive to simply buy a new barrel. It may seem sacrilegious in a gunsmithing book to say “go buy one” but if you want a Modified barrel instead of a Full choke barrel, and the Mod barrel is available, used for $20, why not?

If you do buy one as a practice barrel, your conscience is clear. For your small investment, you can practice to your heart's content.

Scope Mounts

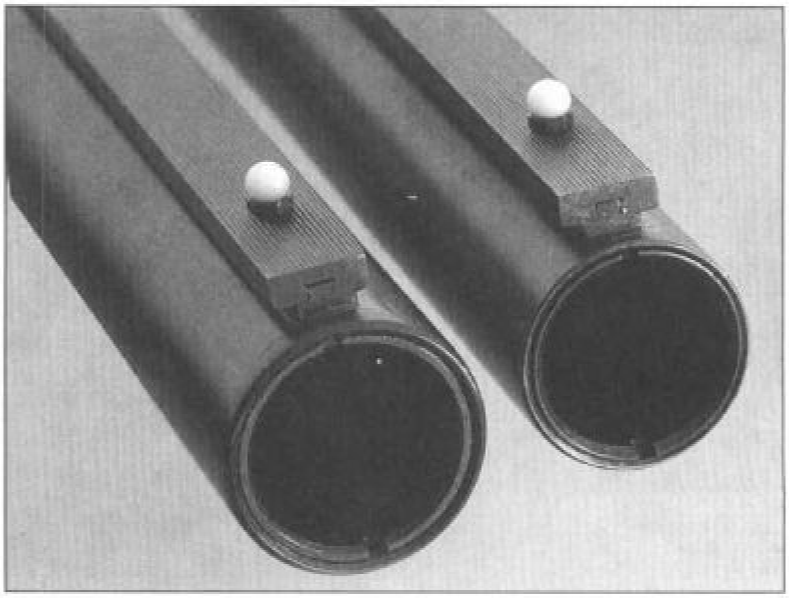
The Mossberg 500 now leaves the factory drilled and lapped for a scope mount. But it wasn't always this way.

If you have an older model, you can drill and tap your receiver to take a scope mount. However, unlike other shotgun manufacturers, Mossberg will do it for you. If you have an older Mossberg that is not drilled and tapped, send it back. The factory will do it for you. If you want to do it yourself, go to Chapter 19 and follow the instructions there.

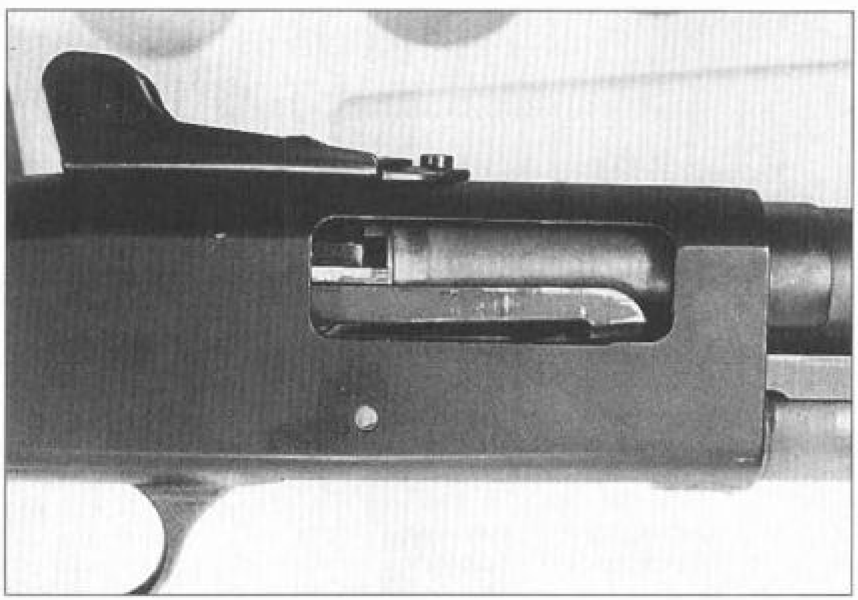
Working on the Model 835

The 835 is the big cannon of the Mossberg lineup. To fill the desires of hunters in the late 1980s for something with better steel-shot performance, Mossberg came up with the closest thing they could to a 10-gauge shotgun. Indeed, the first drawings and test reports talked of it as a 10-gauge, to throw off any competitors who might get a hint of what was going on. The end result was a back-bored 12-gauge chambered in the then-new 3 ½-ich 12-gauge cartridge. Remington had its 10-gauge magnum, but it was an autoloader, heavy and expensive. Browning was going to build a EPS in 10-gauge, but none of the parts would be interchangeable with the 12-gauge BPS.

Mossberg wanted the performance without the specialization. The standard 500 receiver and bolt were stretched in length to handle the longer cartridge, (on the computer design screen, not in the actual aluminum). The other internals were adjusted to take into account the length of the (at the time un-made) new cartridge. Federal wasn't going to make ammunition unless there was a shotgun. Mossberg would look pretty silly if they made a shotgun and no one brought out ammo for it. The two trusted each other and surprised everyone at the 1988 SHOT Show.



The 835 barrel is back-bored its entire length enough so as to be visible. (photo courtesy O.F. Mossberg & Sons.)



The Mossberg 500 receiver is designed to be long enough for 2-¾-inch and 3-inch shells. If you want a 3-½-inch gun, go buy one.

The immediate response from some of my customers was to have their 12-gauge shotguns chambered for the new cartridge. I refused then, and I would do so now. If you want a shotgun chambered in the 3-½-inch 12-gauge, buy one. One customer in particular was insistent, and mentioned his father as an example. “My dad had his Browning opened up for a longer shell. Why can't you do my Mossberg?”

The answer was simple, but took a while to work through. His father's Browning was an A-5 chambered in 2-⅝-inch 16-gauge. Built on a 12-gauge frame, converting it to 2-¾-inch 16-gauge involved creating extra movement of the operating parts, and enlarging the ejection port. Indeed, all any gunsmith who did it was doing, was following the factory procedure to convert it.

There was and is no such procedure for converting a Model 500 to a Model 835. Without a longer receiver, you can't make the larger shell fit. Even if you opened the ejection port (I said “IF”, don't go doing it!) the bolt could not travel back far enough into the receiver to feed a new 3-½” round out of the magazine.

Dream all you want about conversions of an old one, but buy the big one.

Having bought the big boomer, what do you get? You get a shotgun that is slightly heavier than a standard 500, but not so heavy as to be unwieldy. You get the ability to launch heavy payloads of steel shot without blasting your shoulder off. You get Mossberg dependability at a Mossberg price. I may sound biased toward Mossberg shotguns, but I have never been let down by one, and have always found them a reasonably-priced and dependable shotgun.

You will not be disappointed.

Chapter 14
Restoring a Double

Or not.

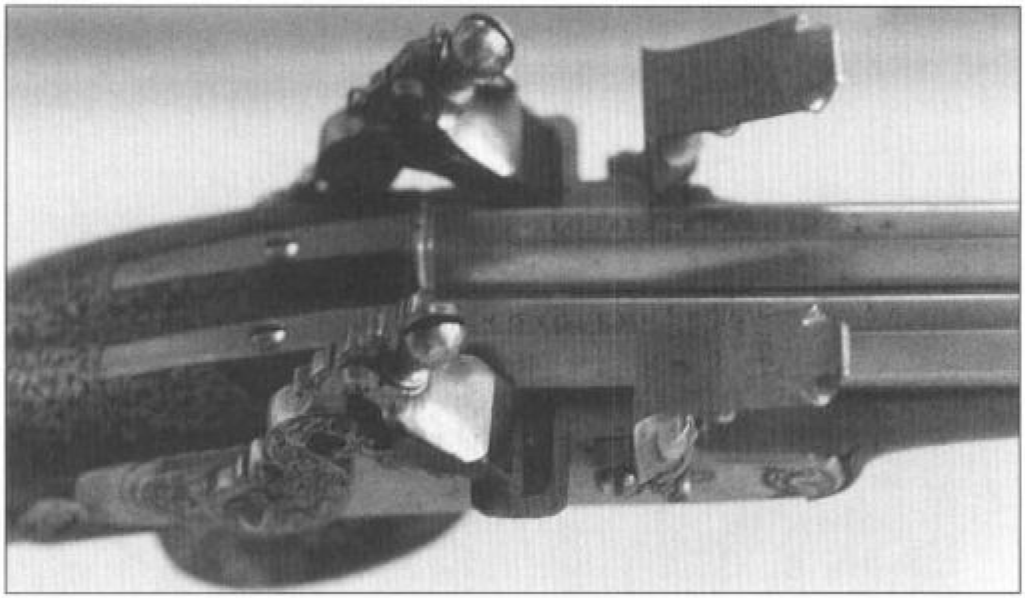
When the your firearm is a muzzleloader, the only way to have more shots available is to have more loaded barrels available. Whether those loaded barrels are attached to the same frame, or are separate shotguns, you have to have loaded barrels.

Not that gunsmiths didn't try. I've seen a number of examples of multi-shot muzzleloaders where the single barrel has multiple charges in it. Each charge would have its own lock. The first charge loaded would be the second charge fired, and the loading procedure had to include some sort of separator wad or card. The gun would be fired by cocking the front lock, and firing, discharging the front load. Then the rear lock would be cocked and fired, discharging the rear load. Getting things mixed up in the heat of combat could lead to “firing” a non-existent front load, or firing the rear one first, launching both. Neither would be fun. I even saw in the French Military Museum at Les Invalides a couple of double-barreled smoothbores with two locks per barrel. One of them had the front locks mounted upside down. I can only surmise that the gunsmith or owner fell that that particular combination made the gun slightly less unwieldy.

With the invention of suitable cartridges, the double came to being. With two barrels, a shotgun can be made light and handy. Add more barrels and it becomes too heavy. The mechanics of attaching and orienting the barrels, positioning the hinge and fitting the firing mechanism consumed the efforts of gun makers for the latter half of the 19th century.

The general layout is simple: You can have the two barrels side by side or over and under. The barrels pivot to open and close. The part of the receiver that the barrels press against to close is called the watertable. The vertical portion of the receiver where the heads of the shells rest is the breech or standing breech. The locks are the firing mechanism. They usually ride right behind the standing breech, and may extend back into the wrist a ways. On the top of the receiver behind the breech is a lever. Pressing the lever opens or “breaks” the action. At its simplest, the hammer double, the top lever only opens the action. The hammers had to be cocked prior to

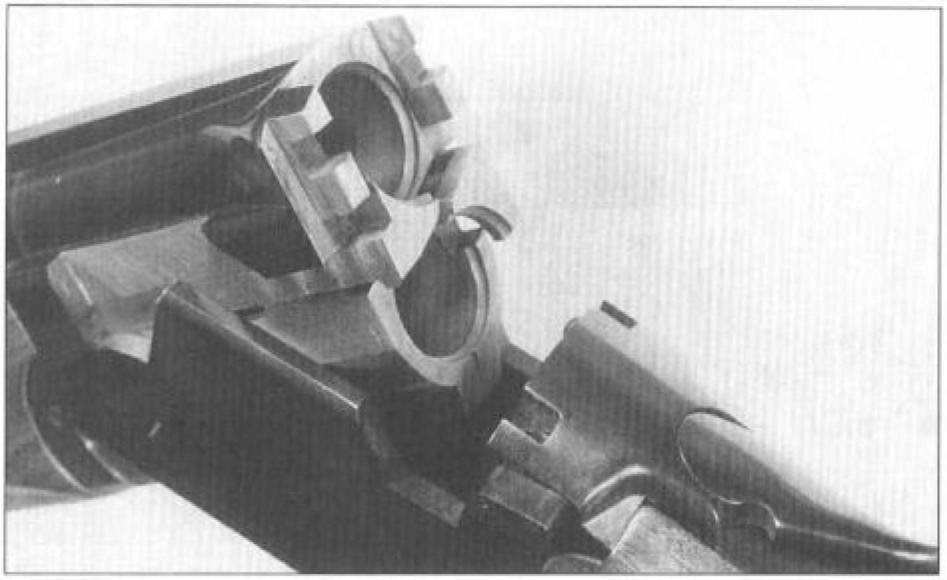
firing. A double may or may not have a safety. For many decades, a double was safe when broken open, and ready to fire when closed.



***When every firearm was a single-shot, the only way to get more shots was to have more barrels*.**

As with so many things, the details are everything. The hinge can be underneath, in which case the barrels tip up when they open. Or, the hinge can be on the side, in which case the barrels “break” to the side. I've never seen a shotgun where the hinge was on top, and I can't imagine why anyone would do such a thing. Not only would it be ugly, but opening the action would move the shells away form the shooter, and the receiver would block his view and reach. The bottom hinge won out over the side hinge.

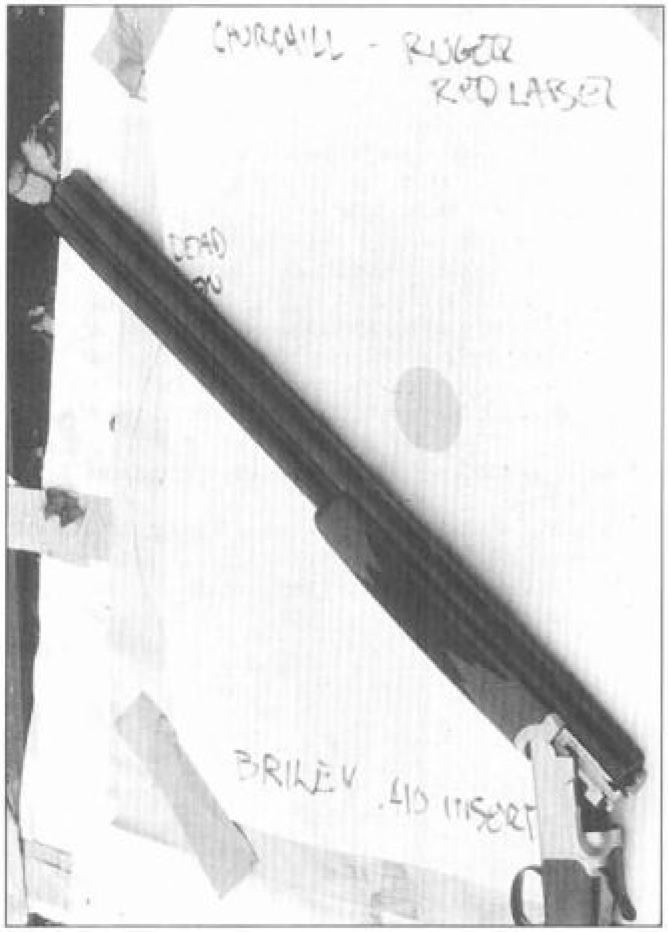
One exception to the hinge location discussion is the French Dame. Instead of hinging the barrels, the Darne uses a sliding breech. When you grasp the lever on the top of the receiver and pull it back, the standing breech slides back and the shells are extracted. I have seen one Darne where the water table was milled out to hold additional cartridges. The mechanism on that one is a selective ejector, and when the barrels are opened, if a round has been fired, it's empty is ejected and a fresh one pops up. Running the lever forward feeds the next shell into the chamber and closes the action. The unfired barrel does not eject, and its second round stays in reserve. Neat, cool and trick. And expensive like you wouldn't believe.



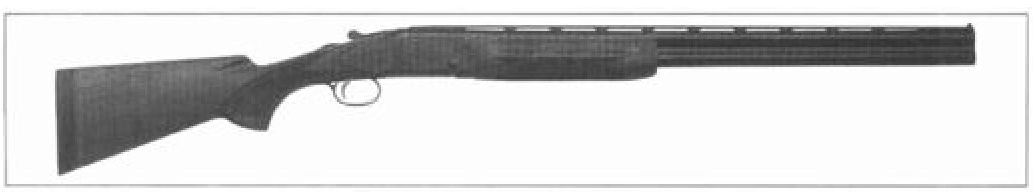
The locking lugs of this Weatherby over/under are beside the upper barrel. The O/U is now the preferred double, replacing the side-by-side for hunting and competition.

Once centerfire cartridges became common, the need or customer desire for external hammers faded away. But just moving them inside raised two issues; the need for lock plates and a means to cock the hammers. In the external hammer gun, the hammers and their mechanism were attached to the plate that rested on the side of the receiver. By simply fastening the hammers on the inside of the plate, the breech area of the shotgun could be made sleek and smooth. The sidelock action came to its final design. A simpler method of making the gun would be to secure the hammers and other parts into the receiver itself. The new style is called the boxlock. Some boxlock shotguns will have sideplates attached to them for looks. The large oval of the sidelock lockplate is a wonderful location for engraving. By attaching false plates, a maker can have the strength and ease of making a boxlock, and the engraving area of a sidelock.

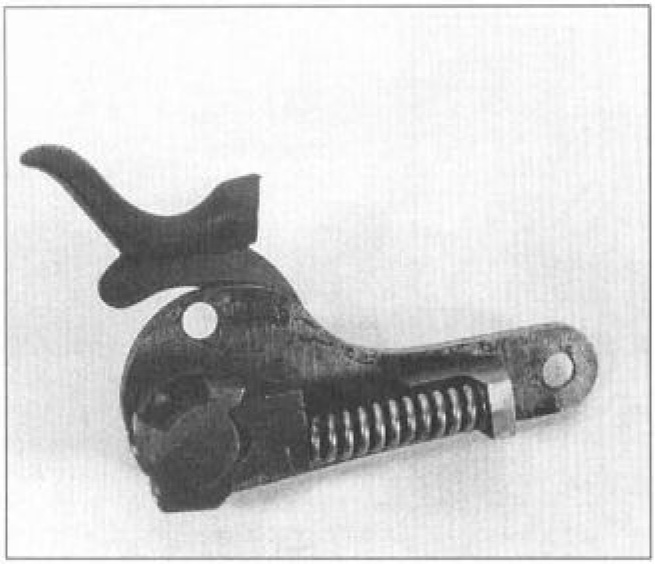
One holdup to installing internal hammers was designing a mechanism to cock those hammers. Many methods have been thought up and created, but they all use the opening action of the barrels to cock the hammers.



The perfected double is regulated so both barrels hit to the same spot.



Remington has been in the shotgun business for well over a century (nearly two now) and is still making double shotguns. (photo courtesy Remington Arms Co.)

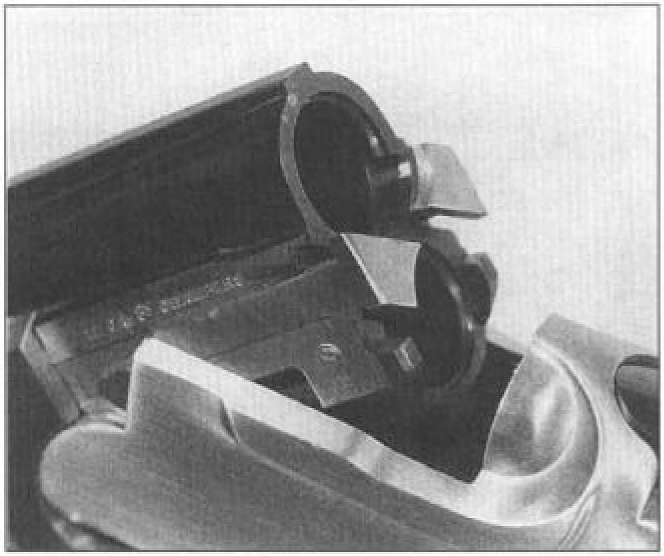


Early in the transition to cartridge shotguns, the lock kept the hammer on the outside. Later it would be moved inside.

As the only useable force acting on the shotgun, opening the action has thus been made to do many things. The extractors of the early mechanisms simply raised the shells for the shooter to pluck out. The ejector uses a spring-loaded trip catch to launch them out. Opening the action cocks the ejector and then releases it. The selective ejector only launches one out when that barrel has been fired. The unfired barrel does not cock its ejector, leaving the ejector/extractor to merely lift the unfired shell.

And finally, automatic safeties were included in the mix. The mechanism can be built, or adjusted so the safety is pushed to “safe” when the barrels are opened. Some shotguns (and rifles) have a selective safety, while others omit this feature. When double rifles were de rigeur for dangerous game, hunters declined ejectors and automatic safeties. (Double rifles are so expensive that even the hunters who can afford to go after dangerous game usually decline purchasing one. After all, when a hunt for Cape Buffalo costs $3,000, why go hunting with a $30,000 investment piece?) The “ping” of ejecting brass might attract the attention of the game, and who wanted the hassle of an automatic safety when tangling with something big, fierce, wounded and heading your way? In the shooting, screaming and crashing through the brush you might not think that the ping of an ejector would be

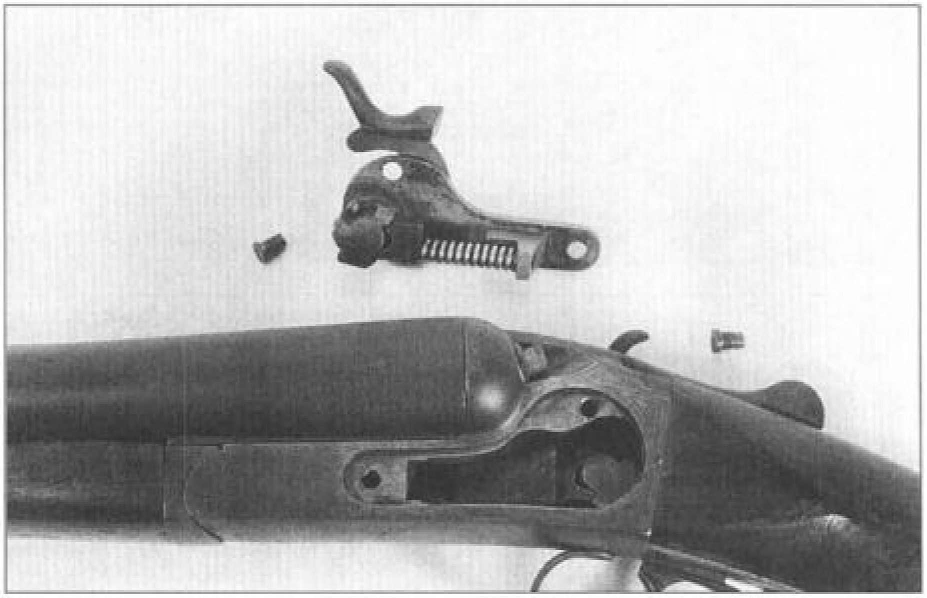
noticed. Guess again. It is not a sound found in nature, and given a chance it would lead the game right to the hunter.



The Ruger Red Label uses a pair of extensions beside the lower barrel to lock the action.

British hunters using shotguns on driven game didn't need safeties, especially automatic ones. The hunter stood still and faced the game coming towards him. His loader stood ready with another loaded gun. With all the shooting and swapping going on in a days shooting, an automatic safety gun would have the safety going back and forth like a tennis ball.

Serious competitors dislike safeties. They stand with the gun open until it is their turn. They then load, call for the bird and fire. In their view, the only thing a safety can do is cost them a bird.



The advantage of the sidelock is that the lock can be cleaned and serviced outside the shotgun. The disadvantage is that there has to be a hole in the side of the receiver for it to fit into.

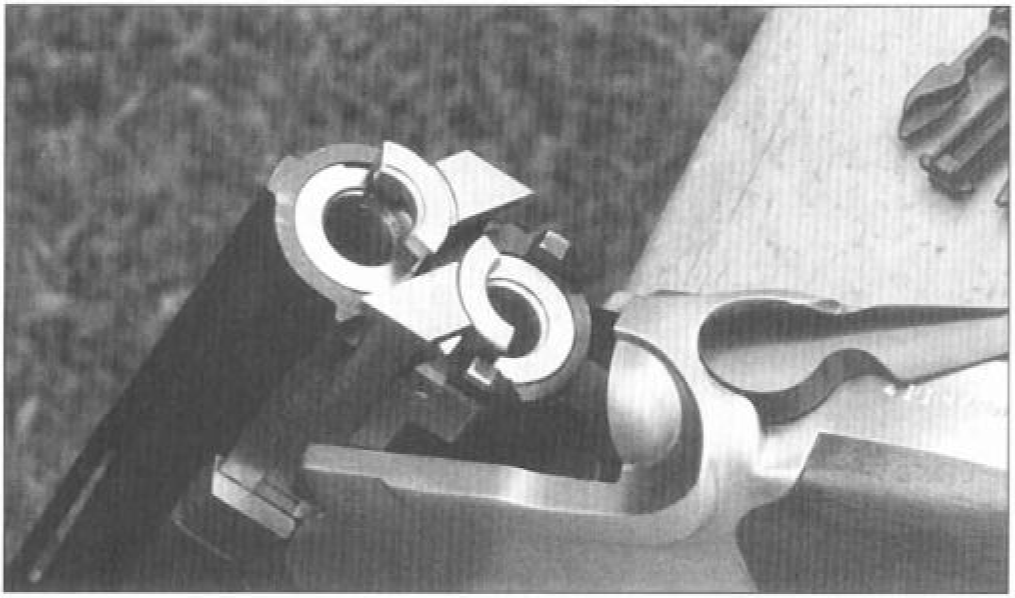
Automatic ejectors are handy, but can be noisy, as hunters using double rifles found out.

Do you need a safety? You bet you do. Unless you are hunting dangerous game, shooting driven game on an estate, or shooting skeet or trap at the highest level, it is essential. You will not be charged by a wounded pheasant. You will not be standing at your post when the drivers beat the grouse towards you. You will not be standing around with your action open, and then close it before calling for the release of the game birds. You'll be walking through the brush with your friends or relatives, and in the time between the flush of a bird and you getting the bead on it, there is plenty of time to push the safety off.

If you're worried there isn't enough time, try a few rounds of skeet starting each bird with the safety on. You'll be pleasantly surprised at how quickly you learn to get the safety off and still crush the clay pigeon.

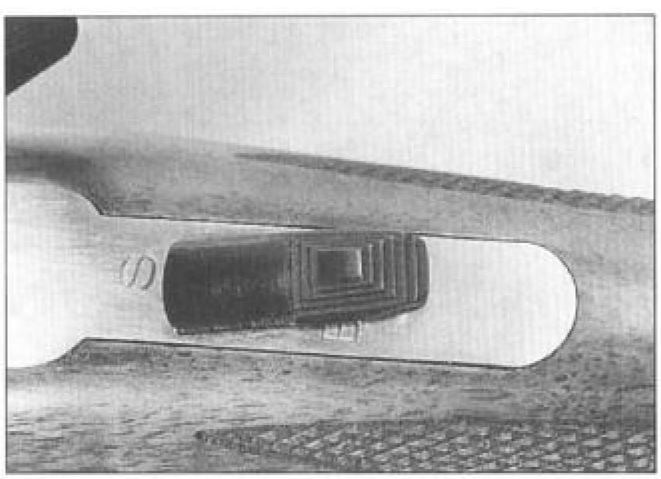
And the lever that starts all this'? It has not always been on top. There have been underlever guns and sidelever guns. For mechanical ease and sleek looks, the top lever won.

The lever simply moves the locking block to open or close the mechanism. The locking block can secure the barrels closed several different ways. One method is called a “doll's head extension.” An extension from the top rear of the barrel junction, it locks into a slot or recess in the standing breech. A variation on this is the Merkel design for overunders, which uses a pair of extensions on the sides between the barrels.



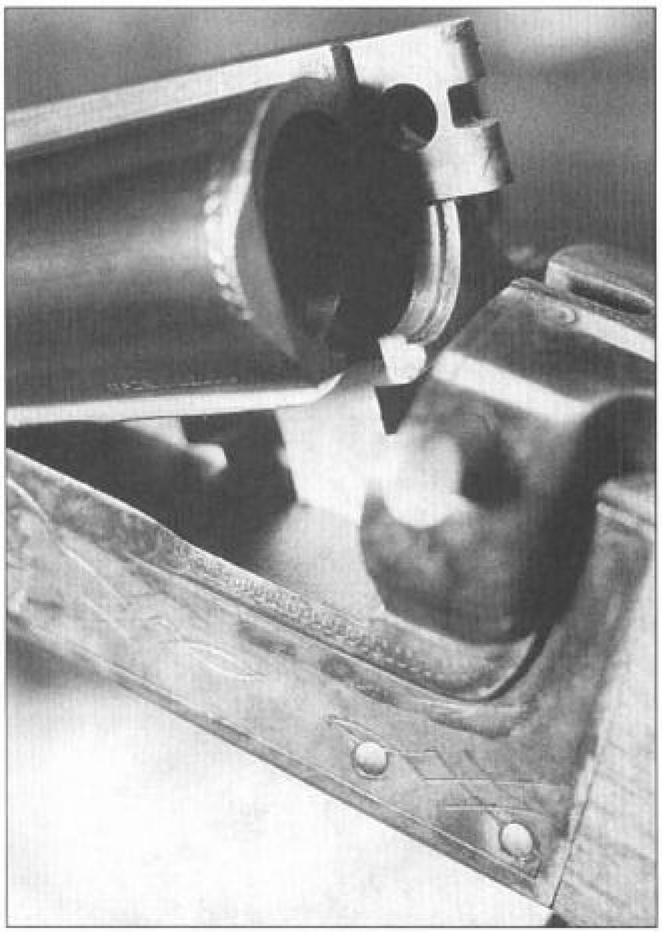
***Automatic ejectors will launch the fired hull, while leaving the unfired on in the chamber*.**

More common is the underlug. The locking lug sticks out underneath and from between the barrels. It passes through the watertable. Under the watertable and between the cocking rods is the latch or wedge. The lever pivots the latch into or out of place with the locking lug. The underlug is a convenient place to put the ejector parts, and using an underlug leaves the rear of the barrels smooth, without protrusions. A smooth breech end on the barrels makes loading or unloading easier.

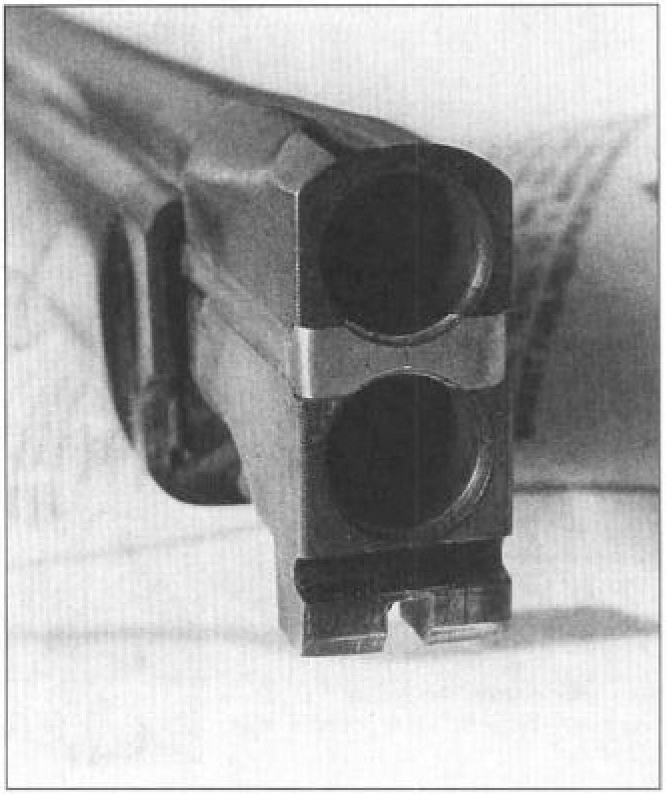


This Ruger uses the safety as barrel selector.

The barrels have to be attached to each other and have the gaps between them filled. The barrels also have to be pointed to the same location, called regulating. The ribs and the barrels on old-style (and old manufacture) shotguns are soft-soldered. The craftsmen who did this (and still do in some shops) would solder the breech together and (it it to the receiver. Then the barrels would be test-fired. If the barrels had to be adjusted to each other and the pattern plate, small wedges would be forced into the fit. Once the patterns were properly regulated the ribs would be soldered on.



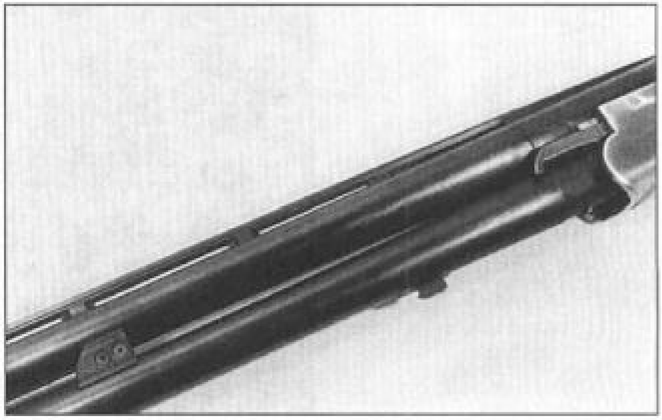
This nice Belgian shotgun uses an extension between the barrels, and a rod through the extension, to lock the action.



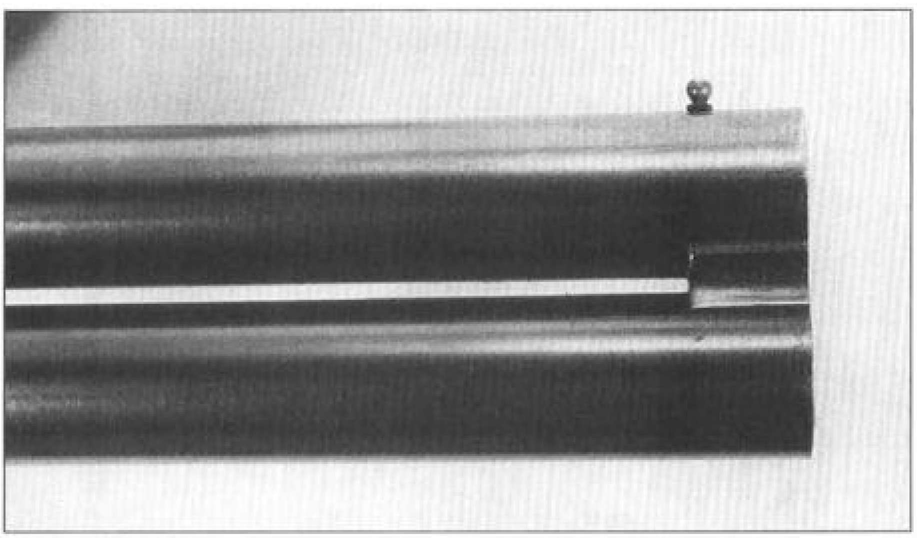
A simple method of locking the double is to put a notch in the bottom of the lug under the lower barrel.

In a modern double, the barrels and ribs are all held in a fixture or wired tightly together using a positioning fixture. The wired assembly would then be sent through the furnace for soldering. The fixture ensures the barrels are regulated.

Double-barrel shotguns are extremely reliable and durable when they are used in the manner designed. If you are going to use your double for competition, driven game in good weather or in bad weather with lots of tender loving care, it will never let you down. If you go goose or duck hunting, it may not be happy with you. Life in a duck boat can be a hard, and the double may not be up to it.



Ruger does not use a side rib to seal the barrel gap under the forearm. Why should they?



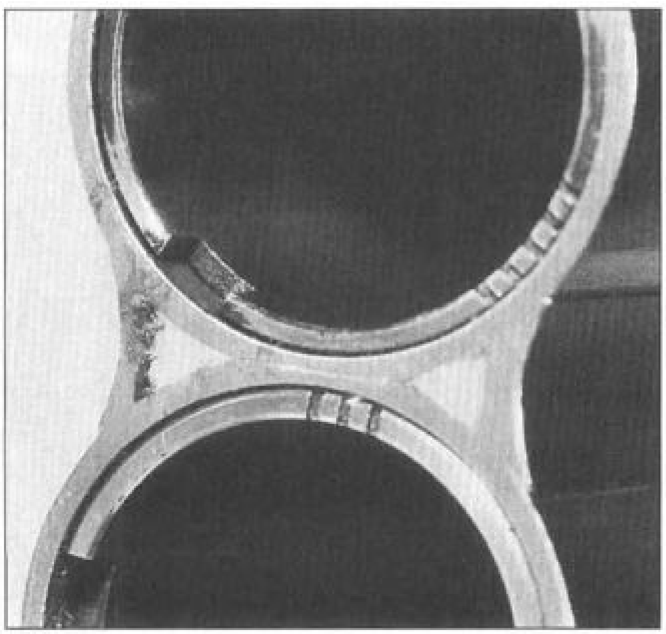
This old Martin Model 90 doesn't have side ribs. Many older and less expensive shotguns did not have them.

Disassembly

The double breaks open. By pushing the lever to the side, the action opens up and exposes the chambers. To take it apart, check to make sure it isn't loaded. Close the action. Underneath the foream you may find a latch or mechanism. Use the latch or wheel or lever to unlock the forearm and remove it. If the forearm does not have a latch, then it is held on with a

spring-loaded catch. Work a fingertip between the front of the forearm and the barrels, and pry the forearm off. Inexpensive shotguns may have the forearm held on with a screw. Expensive shotguns may have the spring-loaded mechanism held to the forearm with a pair of engraved screws. Removing the screws will remove the wood, but leave the latching mechanism attached. No harm done.

With the forearm off, break open the action and pivot the barrels off. You are done. Past this point it gets very particular and can get tricky. I could fill a book this size with nothing but the explanations, diagrams and photographs of how to disassemble the various designs of double shotguns. If you need more than the basic breakdown of your shotguns, it may be time to consult a professional.



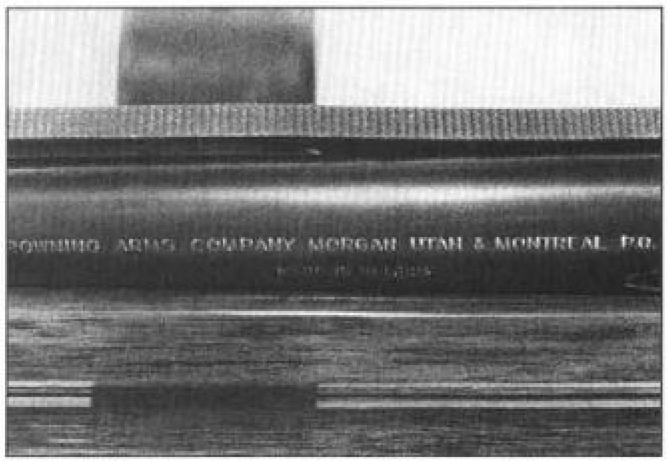
The side ribs and the barrels are soldered or brazed together. The bluing salts may ooze out after it has been blued. A little oil and steel wool will clean the gunk off.

Which Repairs Should You Consider?

Not much goes wrong with a double. There aren't that many moving parts, and they are well-sealed against the elements. The things that go wrong with doubles can be summed up in a few areas. The ribs separate. The

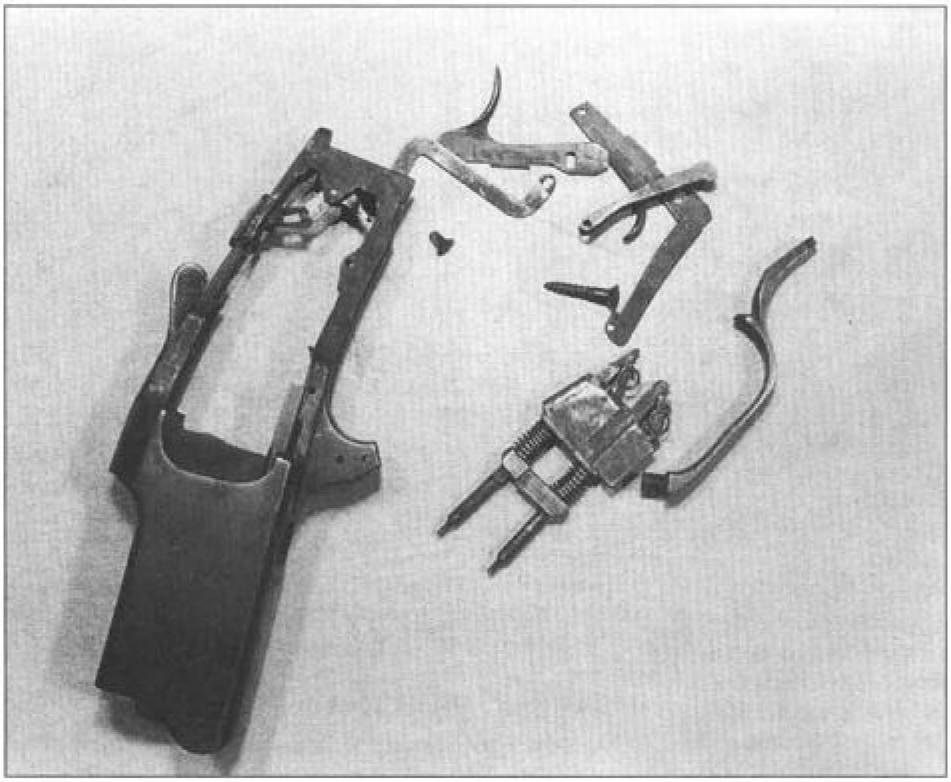
action gets loose. The ejectors stop working, The shotgun won't shoot. The stock or forearm gets cracks.

Some you can handle, some you can handle with help, and some you should not attempt unless you are brave or willing to compromise. If it is a subject you will need help on, be up-front about it. Take it to a professional and tell him what is wrong and what you want to do. Don't try to be crafty and tell him one thing, expecting him to clear up another problem on his way in.



This Browning, like all doubles, is reliable and durable. But push it too far, and like all doubles it can be expensive to repair.

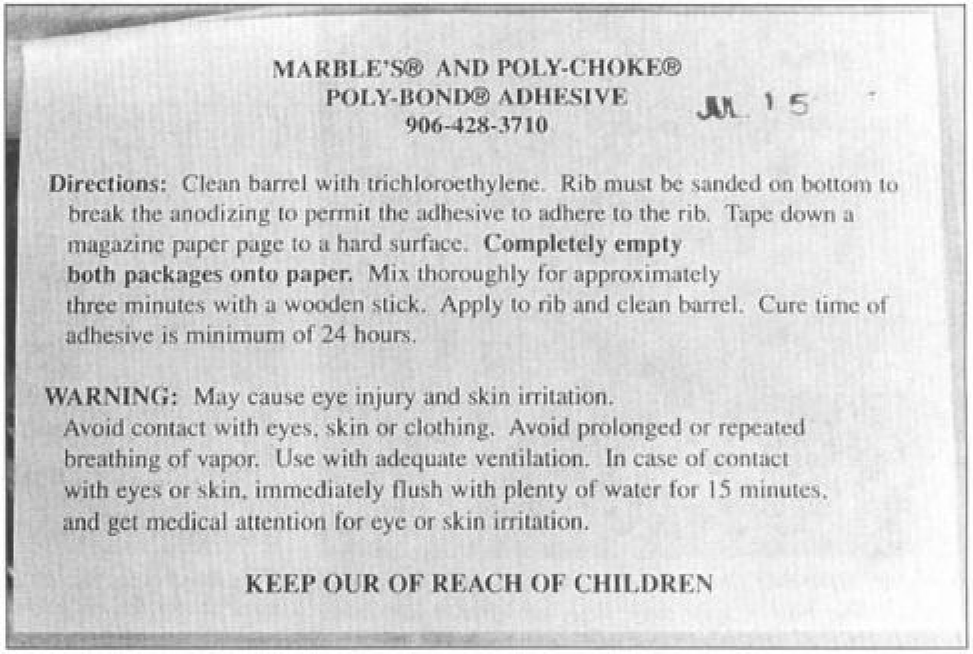
One example of that comes from my own experience. While it doesn't involve doubles, it is instructive. I had a customer come to me with a Remington 1100 chambered in .410. He complained that it wasn't working properly. I stripped and cleaned it, and found nothing wrong. I test-fired it and it worked just fine. (In case you are wondering. .410 loads clear bowling pins off the table. Not vigorously, but they do exit the scene.) I gave it back to him with a bill for the cleaning and test-firing. A week later he was back, saying it wouldn't work. I looked it over and tested it, and told him it was fine. While asking what ammo he used (I had test-fired it with factory loads, and thought his problem might be reloads) he confided in me that he was trying to get it to work with .44 Magnum ammo so he could deer hunt with it. He wanted something more than .410 slugs, and thought a .44 would be just the ticket.



If you do take your double apart and can't get it back together, be sure you have all the parts when you take it to a pro.

Had he told me in the beginning I would have told him right away that it was the wrong ammo, it was dangerous, and he should not do it. He would not only have gotten the advice sooner, but saved himself the cost of the cleaning and test-firing.

If you and your shotgun take a swim, tell your gunsmith. He will clean it right away, and not wait the week or month until it works its way to the head of the line. If what you want is instructions on how to disassemble your double, say so right up front. Let him figure it out, and settle on an appointment in a week or two so you two can sit down and go over things.



MARBLE'S® AND POLY-CHOKE®
POLY-BOND® ADHESIVE
906-428-3710

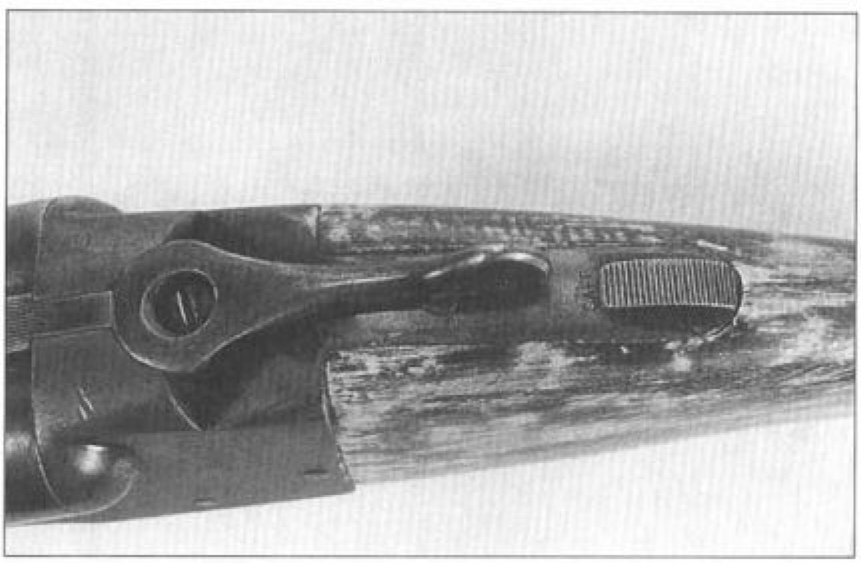
JUL 15

Directions: Clean barrel with trichloroethylene. Rib must be sanded on bottom to break the anodizing to permit the adhesive to adhere to the rib. Tape down a magazine paper page to a hard surface. **Completely empty both packages onto paper.** Mix thoroughly for approximately three minutes with a wooden stick. Apply to rib and clean barrel. Cure time of adhesive is minimum of 24 hours.

WARNING: May cause eye injury and skin irritation. Avoid contact with eyes, skin or clothing. Avoid prolonged or repeated breathing of vapor. Use with adequate ventilation. In case of contact with eyes or skin, immediately flush with plenty of water for 15 minutes, and get medical attention for eye or skin irritation.

KEEP OUR OF REACH OF CHILDREN

Marbles® Poly-Bond® adhesive is a very durable means of reattaching loosened ribs.



The lever on this double has reached center, indicating it may need attention in a decade or two.

Some shotguns should not be worked on at home, unless you are very brave. A London Best double, or other handmade British doubles, should

only be worked on by a professional. Such a shotgun will cost as much as a small car (or a small car loaded with options). While you may like changing the oil on your car, would you do your own brakes? Yes, there is a guy in the back who does. But for the rest of us, if we don't get the job done right, how will we get the car to the garage to finish the job? If you knarf something on your British import, it could be very expensive to repair.

Other imports might be less nerve-wracking. It all depends on cost and availability of parts.

The best double to work on would be inexpensive imports or domestic doubles. One double that is almost impossible to harm is the Savage/Stevens 311. It is a high-temperature solder job, and everything on it is made heavier than needed for the job it does. It would make a great practice gun for someone determined to work on their double.

One thing it will not teach you is how to disassemble your sidelock double. The 311 is a boxlock, and when you take the stock off the action stays put. If you want to be able to work on your sidelock at least for cleaning in case of rain or some other dunking, go to a pro and have him (or her) show you how to dismantle your double.

Rib Separation

You will not see this on a modern double. The silver solder or braze used to fasten the ribs is so strong it will not separate short of a catastrophe. I have seen doubles with bulged chokes where the rib stayed attached right over the bulge.

If the rib has separated it usually means the barrels are a soft-solder job. Re-attaching the rib is a delicate operation, one best left to a professional with experience on soft-soldered doubles. If the gun is one of any name at all, find a pro who can do it and guarantee it.

If the gun is an inexpensive double of no name and you want to get the rib back down, then use the Polychoke epoxy. The formulation of the Polychoke is both black and rubbery. It will adhere to the metal, hold the rib in place and blend in with the color. First, clean the rib and barrel seat. Use narrow strips of emery cloth to polish under the rib and the barrel seat. You must polish without further bending the rib. I have found that using a loaded shell and masking tape, I can support the lifted rib against the use of the emery cloth. The cloth cleans dirt and oxidation from the rib and seat, and smoothes the surface for the epoxy to grab. Spread the epoxy in place and

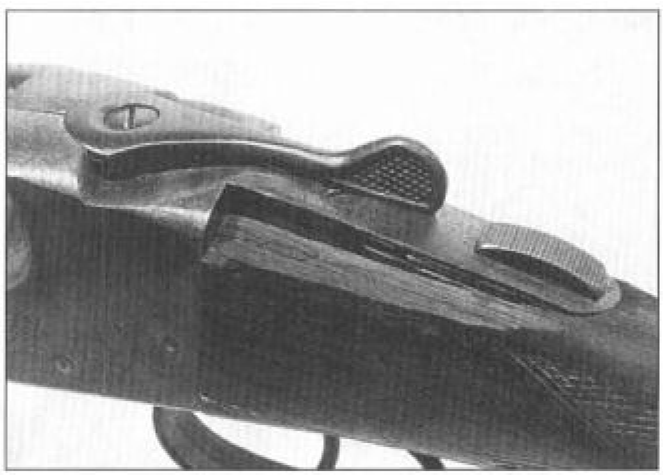
press the rib down. Wipe excess epoxy off the rib/barrel joint. Clamp with a dowel, section of steel rod or a loaded shell, and wrap the barrels and clamping piece with the Brownells surgical rubber tubing. Let it set overnight.

If you have a double at the end of its useful life, and you want to experiment, try re-soldering the rib back on. The trick is getting enough heat into the prepared, fluxed and clamped assembly to fasten the loose part, without loosening the still-attached part.

Bead Repair

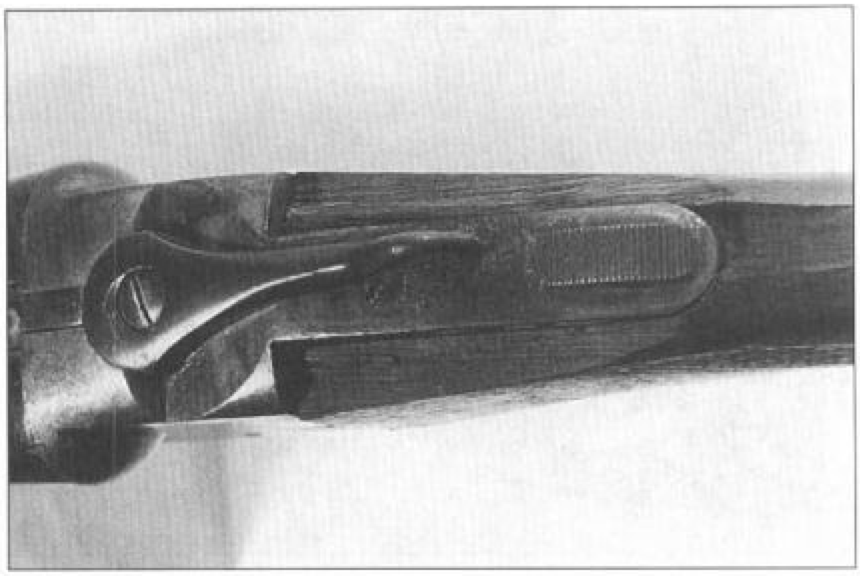
Replacing a broken bead, or just putting on a better one is no different for a double than it is for any other shotgun.

Stock Repair



Hard recoil or hard use can crack a double stock on the top of the wrist. On an inexpensive gun, it can be an excuse for wood repair practice. On an expensive gun it indicates a need for a professional.

The stock on a double is more delicate than on other shotguns. The wrist of the double has to be hollowed out for the locks, or split for the rear connector bar of a boxlock. The wood can split if treated too harshly. In the pre-epoxy days, a split stock on a double meant a new stock on a double. Now, cracks can be repaired.



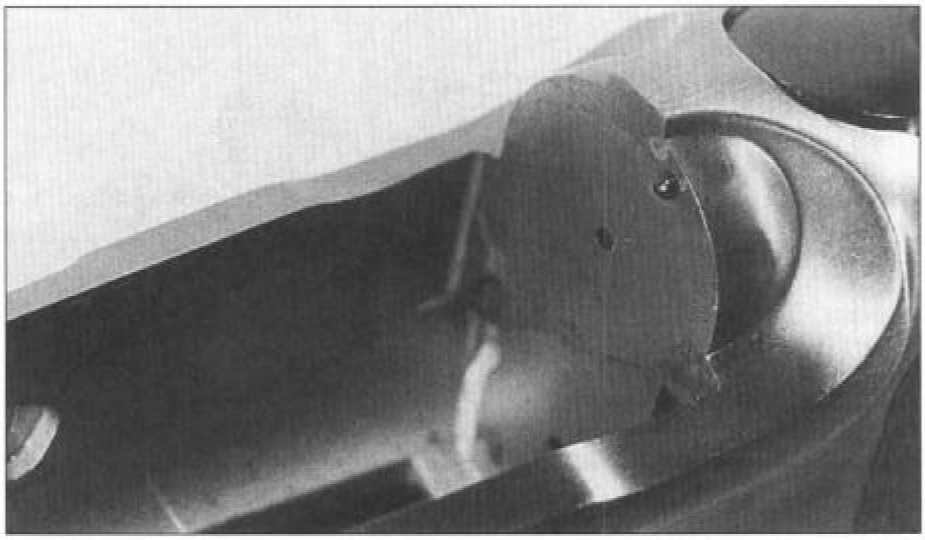
The wrist is cracked on both sides of this double. Time to ship it off to a pro for stock repair. The lever is still right of center, and indicates that locking block wear is not a problem.

One type of broken stock peculiar to a double is the chipped tang. On a pump or auto, the wrist of the stock may crack, but its circular or oval cross-section does not lend itself to chipping. On the double, if the recoil is not evenly distributed, the wood may crack and chip out on the top or bottom of the tang, right behind the receiver. If you find and save the chipped-out pieces of wood, great. If not, then the hard part of the repair will be in finding suitable replacements. One possibility is to go to a professional who does stock repairs and ask for a couple of small sections that match the stock. I kept broken stocks as a source of repair wood.

To repair, you'll need the chip or a replacement, epoxy, clear food wrap and a small bag of lead shot. A nearly depleted bag of shot for reloading will do nicely. You'll need your usual stock repair and refinish tools as well.

With the original pieces on hand, remove the stock from the action. Degrease the piece and the stock. Spray release agent on the receiver and reassemble the stock to the receiver. Mix a small amount of epoxy and spread a thin layer on the chip and the stock. Once you have fit the piece back in place, prop the receiver with a couple of full bags of shot so the chipped portion is directly up. Place a piece of the plastic wrap over the repair, and then weight it down with your partial bag of shot. The odd shape of the wrist prevents wrapping to clamp, so the weight of the lead does the

job. The shot conforms to the shape of the stock, and the wrap prevents the epoxy form slicking to the bag. The release agent on the action keeps the epoxy from sticking to the receiver.



The breechface on this Ruger is smooth, and thus the firing pins must be removed and serviced from the inside.

Once the epoxy sets, repeat the work on the other side.

If you did not find the original pieces, then you start with replacement wood. Use the cabinetmakers rasp to rasp the broken edge to a smooth and flat surface. Rasp the replacement wood to a smooth and flat surface, and fit the front top so it conforms to the contours of the receiver. Leave the exterior larger than the stock. Then epoxy it in place as you did with the original wood. Once the epoxy has set, then use the patternmakers rasp to shape the replacement wood to the contour of the original stock, sand and refinish.

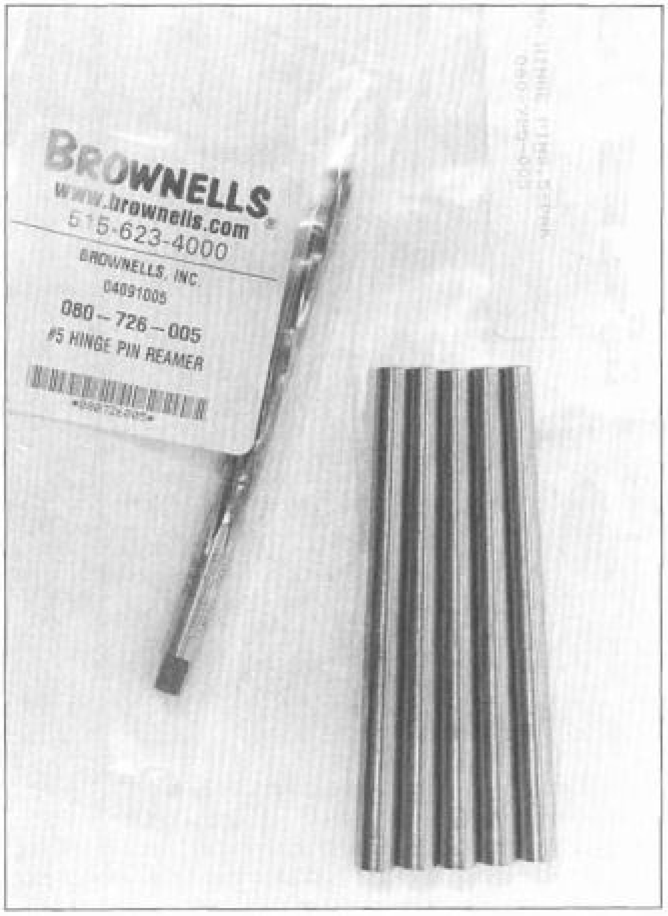
Pad Installation

The same as on any other shotgun.

Firing Pin Replacement

On many shotguns, failure to fire meant to the owner that the firing pin was broken. Most of the time they were wrong. The only pumps or autos I had to replace boken firing pins on were one 870, and two Remington 11's.

The 870 had spent a previous life as a police shotgun, and it had been dry-fired every day. The two Remington 11's dated from before the Depression. Otherwise, every other repeating shotgun brought in for a “broken firing pin” had something else wrong with it.



These are the Brownells hinge pin reamer and replacement hinge pins.

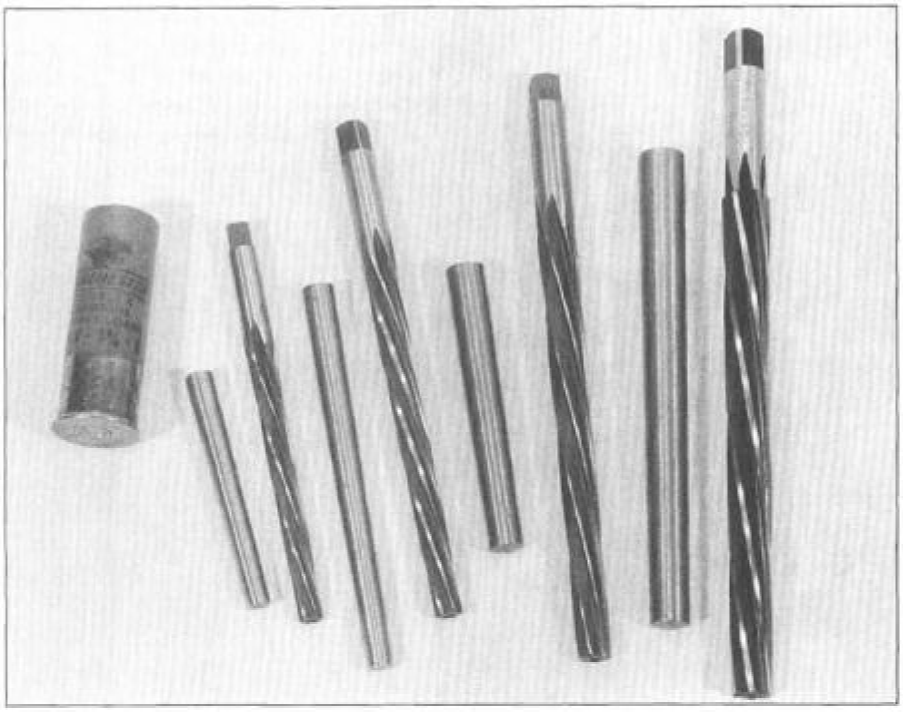
However, doubles seemed to break firing pins. I finally decided that the broken firing pins were from two causes. One, the firing pins on doubles are smaller than they are on the pumps and autos, smaller and oddly shaped. The smaller the firing pin the more it is worked when struck by the hammer. And if there are any sharp edges between sections of the firing pin, or file marks from when the pin was made, they can act as stress risers and starting points for the crack that breaks the pin. The second cause seemed to be dry-firing. All the doubles with broken firing pins were brought in by shooters

who insisted in relaxing the mainspring by snapping the hammers before storing the gun. The springs don't need saving, and the firing pins are delicate. Leave it cocked. In the years I was fixing guns, I never had to replace a broken or weakened mainspring. But, I replaced firing pins on a fairly regular basis.

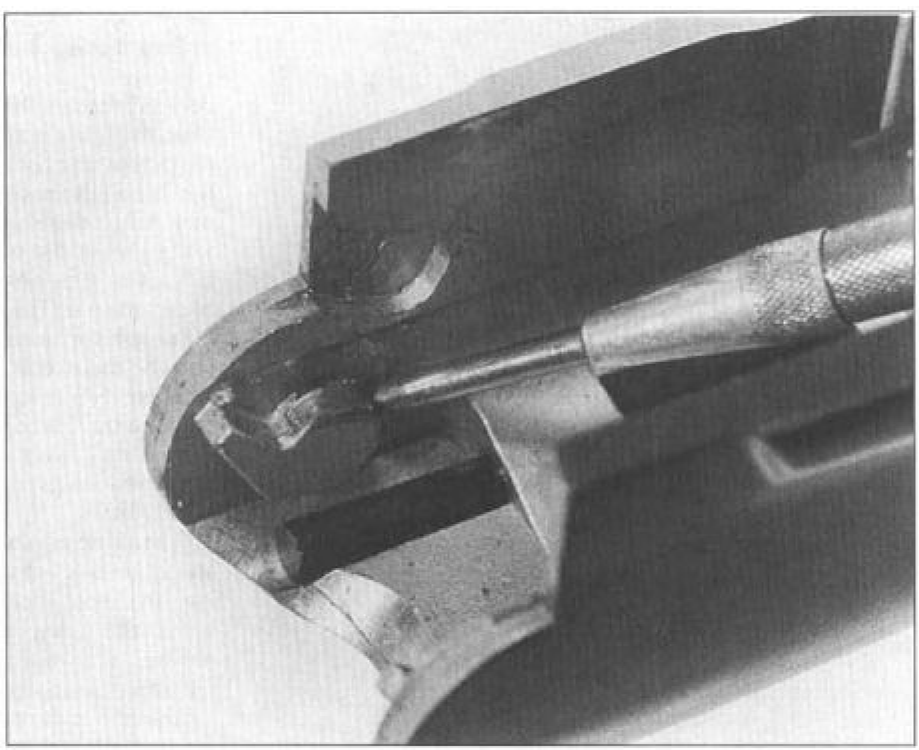
The firing pins are held in one of two ways. On sidelocks and some boxlocks, the standing breech has threaded bushings that hold the firing pin in the receiver. On most box-locks, the firing pins are held in by screws inside the receiver, screws whose heads overlap the retaining flange of the firing pin and keep the pins in place.

To remove the old firing pin you'll need a screwdriver for the boxiock action, and a bushing wrench for the sidelock. You'll need a pair of hemostats for both, and a replacement firing pin. More on the replacement later.

Remove the stock from the boxlock and look inside the action. Inside and right behind the standing breech you'll see a large-headed screw next to the firing pin. Look closely at the screw and you'll see the impression of the hammer on the head of the screw. The screw not only keeps the firing pin in place, it is the forward stop of the hammer and prevents the hammer from smashing the firing pin shapeless. Clamp the receiver in your padded vise. Reach in with your screwdriver. The screw will be tight, so bear down as you turn, to preclude slipping by the screwdriver.



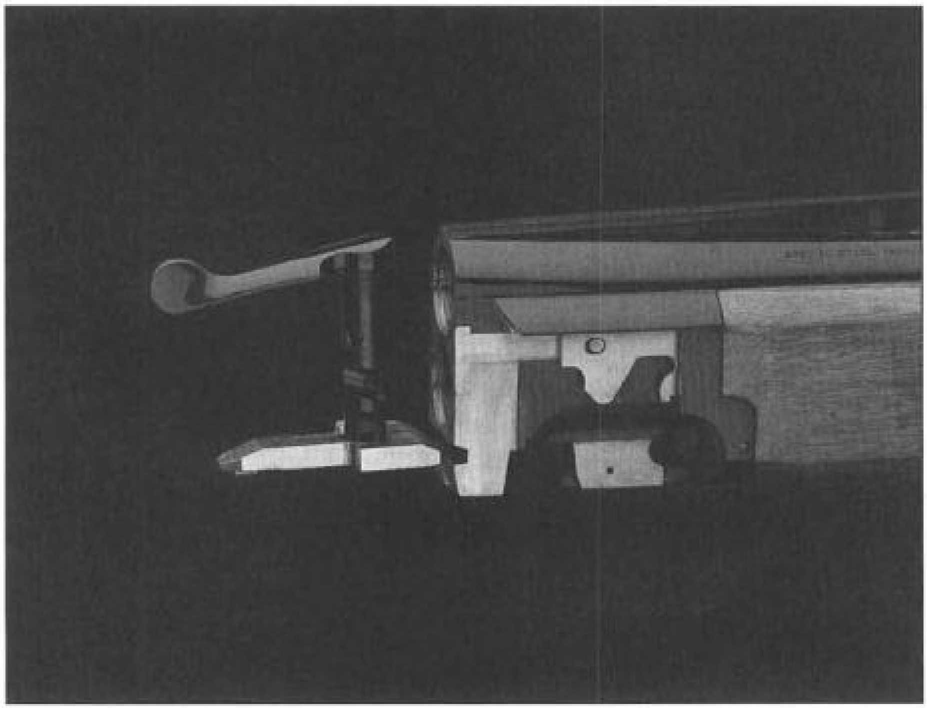
The Brownells pins come in a variety of sizes, for all applications.



The Ruger pivots on trunnions cast into the sides of the receiver.

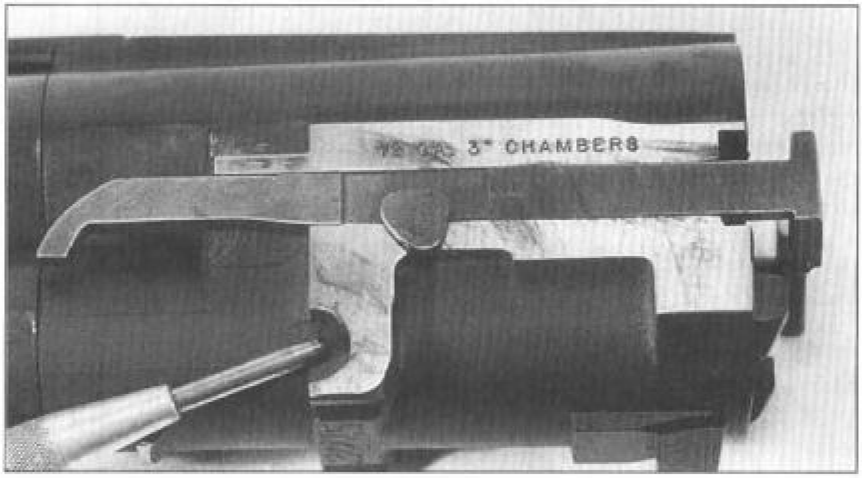
Once it is free, you'll find access to the screw is very light. You'll have to pull the screwdriver out each quarter turn and reinsert it from a different angle. Once the screw is loose, reach in with the hemostats and extract first the screw and then the firing pin. Some actions have spring-loaded firing pins. Gently fish around with the hemostats and see if yours is one of them. If it is, set the spring aside and keep track of it. If not, fine.

On the sidelock action with its from bushings, you'll see a circle around the firing pin. Inside this circle will be two or three holes. The holes are the purchase for the bushing wrench. The wrench has an outside cylinder and an inside bar. Each has a small tip on it. The back end of the wrench is hexagonal so your socket wrench set can be used to turn the bushing wrench. Loosen the locking screw on the cylinder and you can turn the inside rod. Turn the rod until it lines up with the hole spacing of the bushing. Press the wrench into the holes of the bushing, and then tighten the locking screw. Take a felt-tip pen and draw a line across the radius of the bushing. You'll use the line to lighten the bushing back to where it started from, when all this is done.



The taper of the locking block of this Browning Citori is self-adjusting for wear. Maybe in 40 or SO years of shooting it might have to be readjusted, but not sooner. (photo courtesy the Browning Arms Co.)

Clamp the action in your padded vise, breech facing up. Press the bushing wrench into the holes in the bushing. Use the socket wrench to turn the bushing wrench. Press down hard on the socket wrench. The bushing is in tightly, and if you let the bushing wrench slip you will knarf the bushing wrench holes and be unable to remove the bushing.



These notches (one to each side) are the pivot caps of the Ruger. The design allows a lower barrel position. The cups should be treated to a small dab of high-pressure grease each time you clean a Ruger.

Once the bushing is loose, turn it out and remove it from the receiver. Use the hemostats to extract the broken firing pin, and again look for any firing pin return spring.

For either one, you'll need a replacement firing pin. However, you won't know the size and shape of the pin until you remove the old one. Brownells offers a kit of the “usual suspects” of firing pins. With the kit, most shotguns that show up could be fixed. But if you only have one, you don't really need the whole kit. What to do? Make a scale drawing of the old firing pin. Measure every aspect of it as best you can. Fax the drawing to the gunsmiths at Brownells. Include the make, gauge and model of the shotgun, and give a return fax number or address. They will tell you which firing pin replacement is the right one, and if any modifications will be needed. Then you order that pin.

The pin will be too long, and may be too large in either the pin diameter or its flange diameter. You can file the length shorter, and round the lip either by hand or with the firing pin in a drill press. But in the rare event that the only available replacement has a flange or shaft diameter that is too large, you will have to turn it over to someone with a lathe.

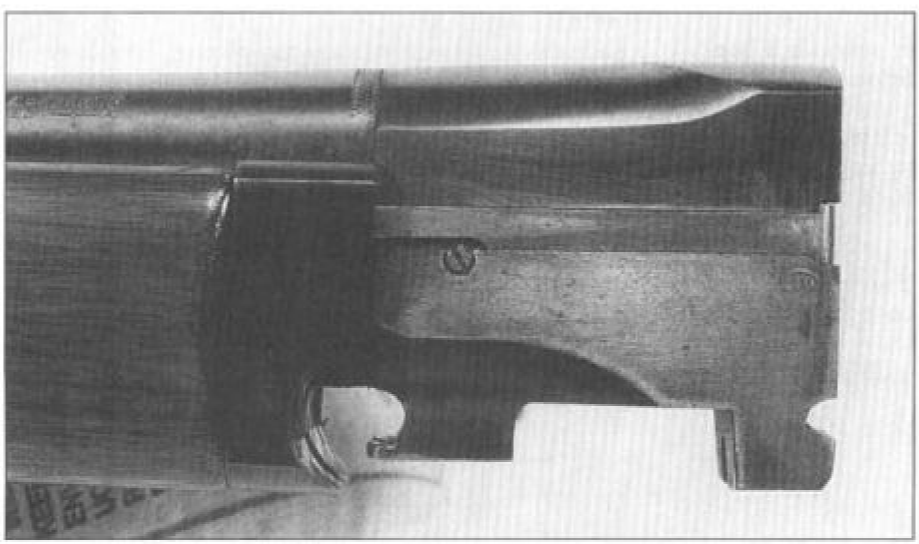
The too-long firing pin must be filed to set the firing pin protrusion. You'll need your files, a dial caliper and a drill press or lathe. If spring-loaded, use the spring while measuring. Place the new pin in the action (boxlock) or

bushing (sidelock) and press it forward. Measure how far it protrudes from the face of the breech. Calculate how much shorter you need to make the firing pin. Normal firing pin protrusion should be about .050”. Remove the firing pin and clamp it in your padded vise and file the tip back to the correct length. Install and measure again. Once it is the right length, chuck it in the drill press or lathe and gently radius the tip with your file.

In returning the firing pin to the boxlock, you'll have to clamp the action face down in your padded vise and with the hemostats drop the firing pin into its hole. Using the hemostats, maneuver the screw into its hole and begin turning it into place. As when removing it, you'll only be able to turn the screwdriver a quarter-turn or so before having to reposition it.

In tightening the bushing you should start the bushing with your fingers. Once you have the threads caught, then you can use the bushing wrench. Turn the bushing wrench by hand as far as you can, and then switch to the socket wrench handle at the end. Tighten the bushing to line up the felt-tip pen mark you made, and the bushing is flush.

In the future, if you absolutely must dry fire the shotgun to “relax the springs” place a piece of soft wood against the standing breech to take the impact of the firing pin. By offering the wood as the impact, you soften the blow the firing pin receives.



***A shotgun that is loose can be repaired by reaming the pivot and replacing the hinge pin*.**

Fixing a Loose Action

Every time you open a double, you work the underlug against the hinge pin. If you use a good grease you can get a lifetime's use out of a double without appreciable wear. Not all shotguns are so lucky. A loose shotgun is easy to uncover. Open it up and check to make sure it isn't loaded. Close it and remove the forearm. Grab the receiver in one hand and the barrels with another. Can you wiggle the fit? Do the barrels wiggle side to side? Can you pull the barrels forward and push them back, and feel some movement?

The hinge pin has to be replaced. Not all shotguns are candidates for replacement. Some do not have an integral pin. Using trunnions instead of a hinge pin, the fit of some doubles can't be easily tightened. The oldest guns, built in the days of black powder, should not be repaired. If it is repaired, someone might shoot it. Some guns will be difficult hinge pin replacement jobs. Some shotguns have pins or screws that pass through the hinge pin. Some shotguns have the hinge pin relieved so the cocking rods can pass through to the hammer. If your shotgun is worn, has a solid hinge pin, but has one of these complicating factors, you might want to pass on replacing the hinge pin.

If you want to proceed, you will have to duplicate the relief cuts on your replacement hinge pin.

Shotguns that are tight in their side to side and front to back fit, but tip up slightly, do not have a worn hinge pin. They suffer from wear on the locking slot. A good-quality double has the locking slot and its tab cut at a slight angle. As the fit wears, the lever moves farther in the locking direction until the action locks tight. Such a loose gun has all of the travel used up in wear, and requires a professional.

Brownells makes a hinge pin reamer and hinge pin set that covers all the common sizes. You'll need the reamer, a replacement pin, gunsmiths block and ball peen hammer, hacksaw and files. A small amount of Loctite would be useful but is not a must-have item. If you do not want to invest in the whole reamer and pin set, and only want the size for your shotgun, measurements are in order. Measure the diameter of the hinge pin on each side of the receiver. Measure the distance from side to side of the receiver. Write these down and make a drawing, and send it to Brownells. The guys in the gunsmith department will check your measurements against the pins and reamers, and select the one that fits your shotgun.

Strip the receiver. Remove the stock, and if your shotgun is a sidelock, remove the locks and trigger plate. On a box-lock you can leave the hammers and triggers in. Closely inspect the receiver to make sure there are no pins, screws or other parts through the hinge pin. Trace the path of the cocking rods and see if they pass through the hinge pin. Most box locks will be an easy look, as the cocking rods are built into the underlug.

Once you have determined that the hinge pin is clear of potential locking or binding parts you have to remove the old pin. Place your gunsmith block on the bench and place the right side of the receiver on the block. Line a suitable hole in the block up with the hinge pin. Take a drift punch that is close in size but smaller than the left end of the hinge pin. If the drift punch is too large you'll mar the receiver and not remove the pin. If the drift punch is too small you'll peen the end of the pin and prevent its smooth removal. With a medium-weight ball peen hammer, drive the hinge pin out from the left to the right side.

Once the pin is out, you should be able to easily see the worn section. The temptation here is to turn the pin so the clean side is against the underlug, and reinstall it. Unfortunately, the underlug is worn, too, and you won't be removing all the play. Use the new pin. In days gone by, it was common for homeowners to have the doorsill of their front door turned over when the stone became worn. A couple of generations later, the grandkids had to have the stone replaced because both sides were worn. You may find that the hinge pin has already been turned, and you don't have any choice in the matter.

Check the fit of the new hinge pin. It should on its smaller end just stick out of the receiver when inserted. If a selected pin doesn't come to the other side, you'll have to do a bunch of reaming to get it to come flush. A pin smaller than the hole will protrude, but that is not a problem. You will be cutting off the excess, so as long as the pin is not so undersized that the large end comes flush, you're fine.

Now you must clamp the receiver and barrels together. You can use a padded “C” clamp, or a padded vise. With the receiver and barrels clamped. Fasten your reamer in a large tap handle. Brush cutting oil on the reamer and insert the reamer into the receiver. Turn the handle a couple of turns and then pull it out. Brush the hinge pin hole clean and look inside. You'll see that part of the hole has been reamed, and part has not. When the freshly-reamed surface extends the length of the hole, you are done.

Remove the reamer, clean it and store it away. Remove the barrel and receiver from the vise and clean the cutting oil from the barrel. Check the fit of the new hinge pin in the receiver. It should protrude a bit farther from the receiver than it previously did. Degrease the receiver and the hinge pin. Stick the pin in one more time and mark it front and back with a felt-tip marker. Pull the pin out and spread a small amount of Loctite on the hinge pin just inside of the two felt-tip marker lines. Only a small amount is needed. You already have a reamed tapered hole and a precisely-tapered pin. You only need a little insurance, and too much thread-locker will simply ooze where it isn't wanted.

Slide the pin into the receiver and place it left side down on the gunsmith block. Drive the pin as far into the receiver as you can, but don't strike the new pin any harder in inserting it than you had to strike the old one to remove it.

The barrel should now be a tight fit and not wobble at all when closed.

The rest is simply a matter of patiently removing the excess pin sticking out of the receiver. If you are careful you can file the pin down flush with the receiver and not have to refinish. If you will be refinishing anyway, then carefully file and polish the new hinge pin flush on both ends and then proceed to the receiver refinishing

Chapter 15
The Remington 870

Prior to the debut of the 870, Remington had made a number of different pump shotguns. Starting with the Model 1910. (production started in 1908, and it was initially called the “Model of 1908”) and later called the 10, Remington made a shotgun that was very much a product for the times. In disassembly it came apart like the Winchester 1897. After releasing the magazine tube end catch, you turned the magazine a quarter-turn and pulled it forward. While the 10 did not have to have the bolt retracted for disassembly, it was due to a bevel on the barrel that cammed the extractor, rather man an internal ring that kept the barrel and extractor apart as on the Winchester.

The neat thing about the Remington 10 was the shell lifter. It was more a flapper than a lifter. The lifter turned on a shaft that ran parallel to the barrel. As you worked the action, the lifter pivoted down to catch a shell, and then up to present it to the chamber. Unfortunately, if the 10 became too worn, the timing of the lifter lagged, and shells fed out would be spat out onto the ground.

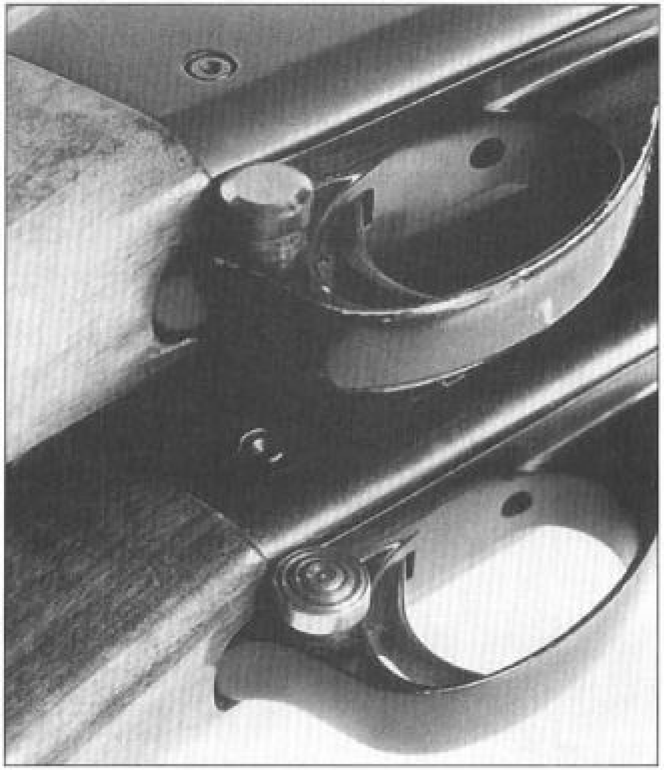
The Remington had to be popular with left-handed shooters and those shooting in a crowded duck boat or blind. It was loaded and ejects from the bottom. It suffered from the same drawback as all other shotguns of the time, the expense of spare barrels.

Remington came out with the Model 1917 as a companion piece in 20-gauge. (I've only seen Remington 10's in 12-gauge, and it is reported to have only been made in 12). The 1917 was light, handy, and it also loaded and ejected from the bottom, just like the 10 did. Designed by John Browning, it did away with the pivoting flapper, and instead, used a forked lifter that pivoted at the rear of the receiver. The Model 17 also introduced another change: the magazine tube was permanently attached to the receiver. A replacement or extra barrel did not have to have its own magazine assembly and the expensive machining for the attachment threads. Unlike the Model 10, which began production in 1908, the debut of the Model 17 was delayed by war production. It did not appear until 1921.

In the late 1920s, Remington upgraded the Model 10 and called it the 29. The 29 was more economical to produce than the 10, more reliable and

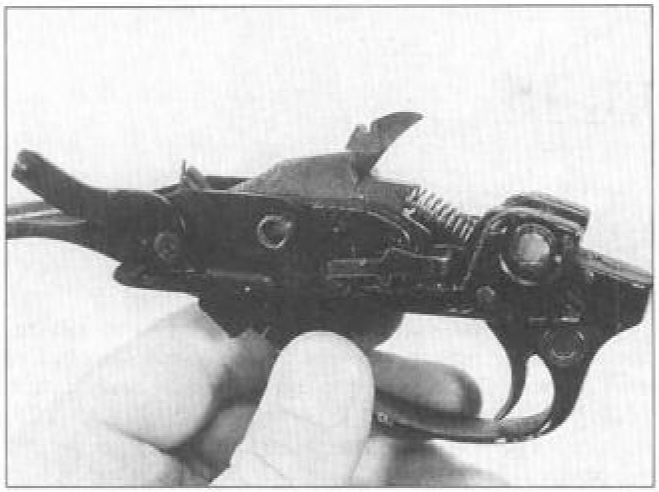
more durable. It had a short run. Soon after, the Remington pump that would change everything appeared. The Remington Model 31 was introduced in the early years of the depression. It differed from ail previous Remington models in that it used side ejection. It also used a large number of stamped steel parts, a radical cost-cutting innovation in 1931. By 1933 Remington had dropped all other models of pump shotgun from production. The Model 31 was superior in performance to the old 10, less costly to manufacture than the 29 or 17, and had the interchangeable barrel benefits of the 17. As gilding on the lily, the Model 31 came in 12, 16 and 20 gauge. The 10 and 29 disappeared, but the 17 went on to become the Ithaca Model 37.

The Remington Model 31 also had another advantage that shooters of the time quickly discovered. It was smooth and easy to pump. Compared to the large and heavy moving parts of the Winchester 1897 and 1912, or the Remington 10 & 29, the moving parts of the Remington 31 were wispy in weight. Especially when compared to a 97, the 31 felt like it was working on ball bearings. Despite its many advantages, the 31 had a short and unhappy life. Selling shotguns in the Great Depression was a slow and painful job. If someone was using a shotgun to put food on the table, they weren't going to go out and buy a new one.



Pump and auto, same housing, different internal parts. Both held in place by simple cross pins. In more than 40 years, there has not been a need to change it.

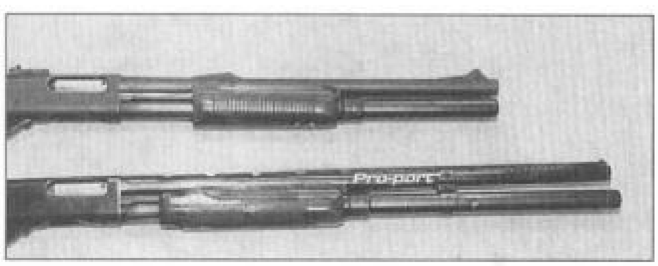
With the arms buildup for World War II, anything that could be produced in a common caliber was made for and purchased by the government. Even though the Army had given up on revolvers at the turn of the century, Smith & Wesson made hundreds of thousands of .38 Special revolvers for use by downed airmen. As an issue weapon for plant guards, warehouse and shipping guards, and security personnel who didn't need a top-line military weapon, shotguns made a lot of sense. The services needed combat shotguns, but the military requirements dictated a heat shield and bayonet adapter, and only the shotgun the military parts would fit was the Winchester Model 12. All other shotguns were purchased for practice, training, guard and recreational uses.



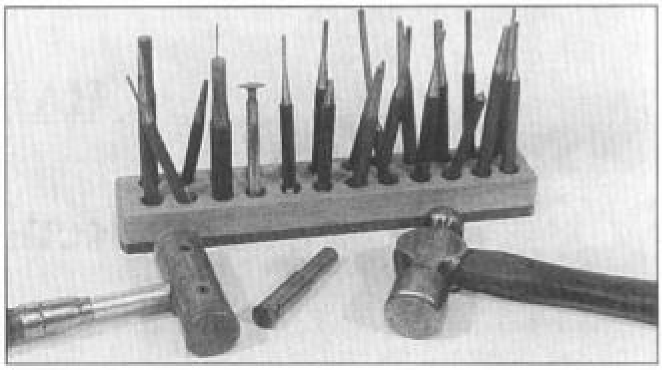
The Remington 870 trigger assembly uses the same housing as all other Remington shotguns since 1950. The difference is what parts are assembled into it.

As war production slowed down late in the war. Remington planned to switch over to peacetime production. One of the desired features of new models was lower cost. With new machines and lower-cost production. Remington would be well-situated in the peacetime economy.

Remington did better than lower costs with new designs. The new models were designed to have as many parts in common as possible. The new 870 pump and 11–48 automatic used the same trigger assembly housing, with most of the same trigger assembly parts installed on it. The receivers were the same, with minor last-step machining differences to accommodate each model parts. Aiding the design and cost-cutting was the boil-to-barrel lockup. By using a barrel extension as a locking slot for the bolt, the stress of firing was contained within those parts. The receiver only had to keep dirt out and the internal parts properly located to each other. Since it did not have to bear the stresses of firing, the Remington receivers were lighter and less expensive than other shotguns.

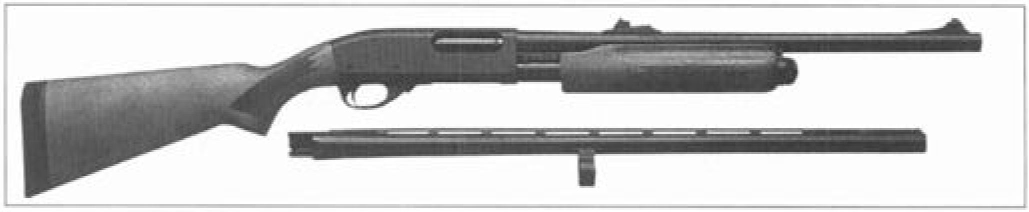


When shooting bowling pins, you need eight rounds of buckshot. For that, you need an extended magazine tube. The 870 is just the thing.



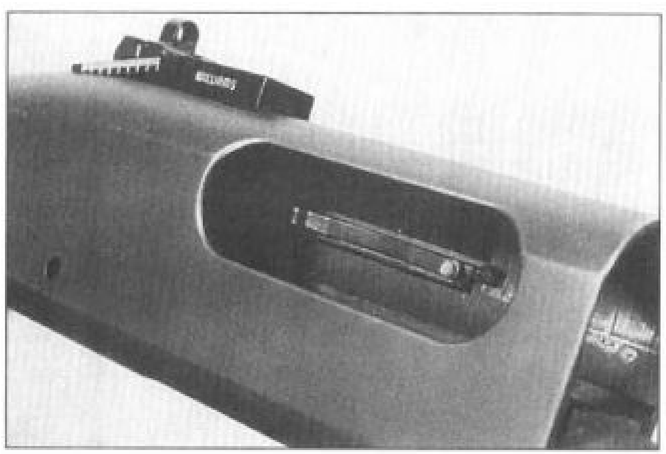
Regular drift punches will work to disassemble the Remington, but you risk scratching the push pins or the receiver if your drift punch slips.

The Brownells pin pusher has a dome in its tip, to stay on the Remington push pins and not slide off.



The design of the 870 means replacement barrels can be inexpensive, and simply installed and not require fitting. You can even buy an 870 as a two-barrel set, and do more shooting than ever.

The new Model 870 pump was an immediate success. It was light, streamlined, handy, the barrels could be easily changed at relatively low cost, and best of all it was durable. It still is durable. For 25 years Richard Davis has held the Second Chance Bowling Pin shoot each summer in northern Michigan. For 20 of those years some type of shotgun event has been on the schedule. Shooting bowling pins is a fast and furious affair. A shotgun shooter has to deal a dose of buckshot to each of eight bowling pins in a matter of four or five seconds in order to be competitive. In the course of the week's match, a shooter could easily shoot in a shotgun event 20 or 30 times. For all that time. Richard has had a brace of loaner pump shotguns. Remington 870s. He has never had a shooter bring one back and complain that it malfunctioned. Year after year, shooter after shooter, hundreds of times a summer dealing with thousands of rounds of buckshot, and they have not faltered.



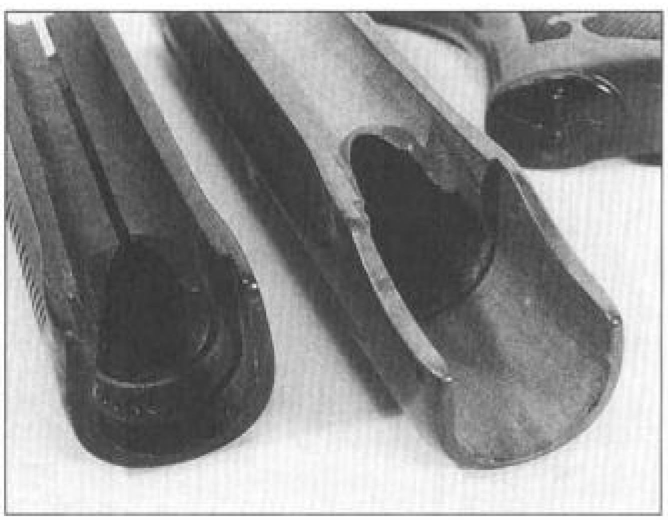
***The Remington ejector is a simple spring steel clip that never breaks. If you do break it, turn it over to a pro, as it requires special staking tools to install. The tools cost more than the job pays*.**

However, nothing is perfect, especially anything made by man. Some 870s do break or malfunction, and must be fixed. What goes wrong?

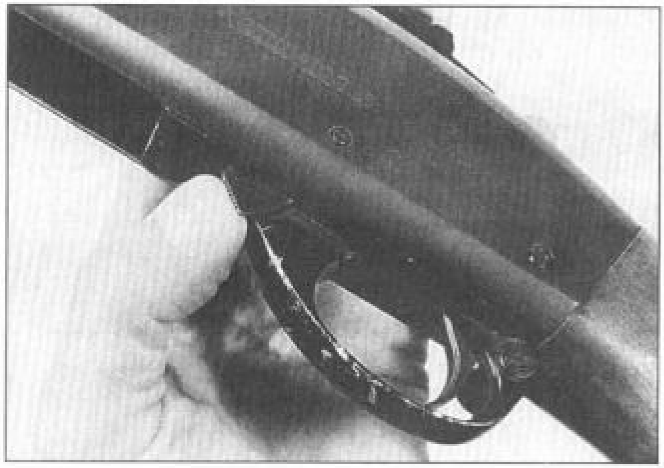
The stocks crack, the forearm wood breaks, the shell stops become loose or break, and the beads fall out. Unlike the Remington 1100, the extractor on the 870 is not prone to breaking or coming out, but it has been known to happen. A broken or missing bead is a simple repair, and one that has been covered already.

The cracks in an 870 stock happen in the usual places, on either side of the wrist, and at the toe to the sling swivel stud. Both repairs have been covered earlier.

The broken forearm wood is a problem that you fix in the exact same manner as with the Mossberg. With a wrench, loosen and remove the retaining nut. The forearm on the 870 slides over the action bar tube, and is retained by the nut. While you have the old forearm off, you should clean the action bar tube of rust and seal it with paint or lacquer to prevent future rusting.



***The forearm of the 870 slides over the action tube, and is held on by a nut at the front. Replacing the wood is usually quite simple. When it is difficult, it is because of age and rust on the tube*.**



To open the action without pulling the trigger, you need only press the release tab.

The big thing with the Remington 870 is loose or broken shell stops.

The 870 is an easy shotgun to take apart. Make sure it isn't loaded, and run the action back. At the end of the magazine tube is a knurled nut. Unscrew the nut, and you can then slide the barrel forward off of the magazine tube. Run the slide forward, but don't slam it into the receiver stop. On the sides of the receiver are two pins. Press the pins out to either side. The trigger assembly will then come out of the bottom. You may have to tug on it a bit, but it will come free.

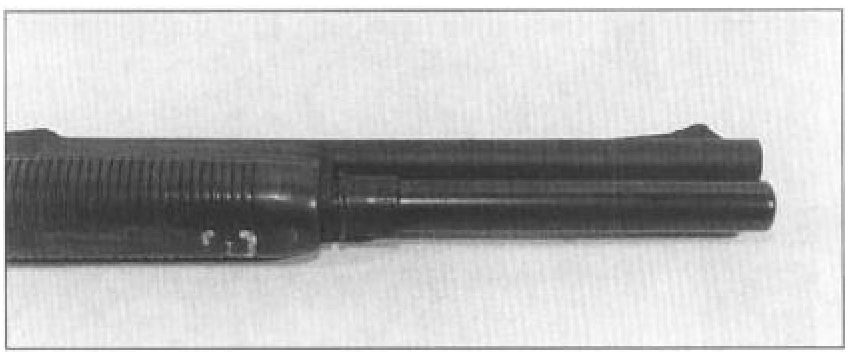
Turn the receiver over. On the inside of the receiver you will see two fiat springs. These are the shell stops. At the moment, they are keeping the bolt and action bar assembly in the receiver. Reach in with a fingertip and press the left one towards the outside of the receiver. The “left” one is the one farthest from the ejection port. It is on the left in the shooting position, but on the right when you have the shotgun upside down, looking at it to remove the forearm. With the shell stop depressed you can then run the action forward out of the receiver. Running the action forward out of the receiver without depressing the shell stop can loosen it over time, and a loose shell stop can cause improper feeding.

The action bars, bolt and slide are not attached. When they come free they will fall to the bench if you do not catch them. Wipe the powder residue off the parts, and apply oil, Scrub the bore.

To reassemble, you have to exercise a bit of manual dexterity. Stand the action upright, or hold the buttstock between your legs as you sit. Place the

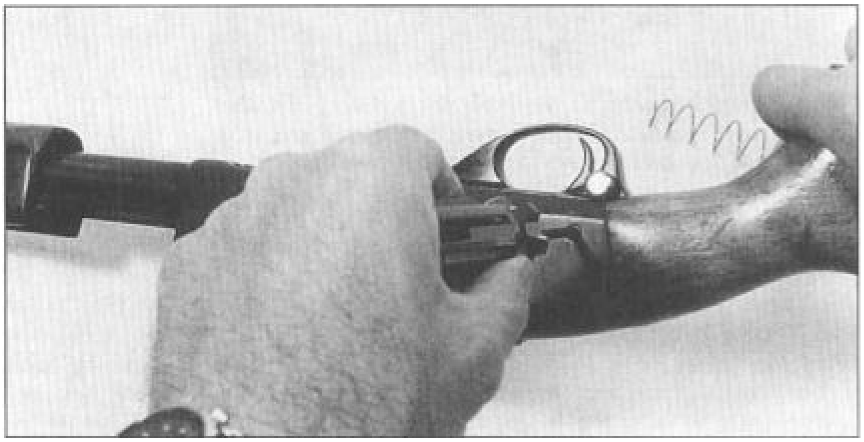
bolt on the slide. Grasp the forearm with your right hand, and pick up the bolt and slide with your left. Line the action bar recesses up with the cuts on the slide, and hold the assembly together. Slide the action tube over the magazine tube, and guide the bolt and slide into the receiver. Stop when you feel resistance. If you force the action bars into the receiver past the shell stops (or rather, attempt to) you will force the shell stops out of their slots, past their stakes.

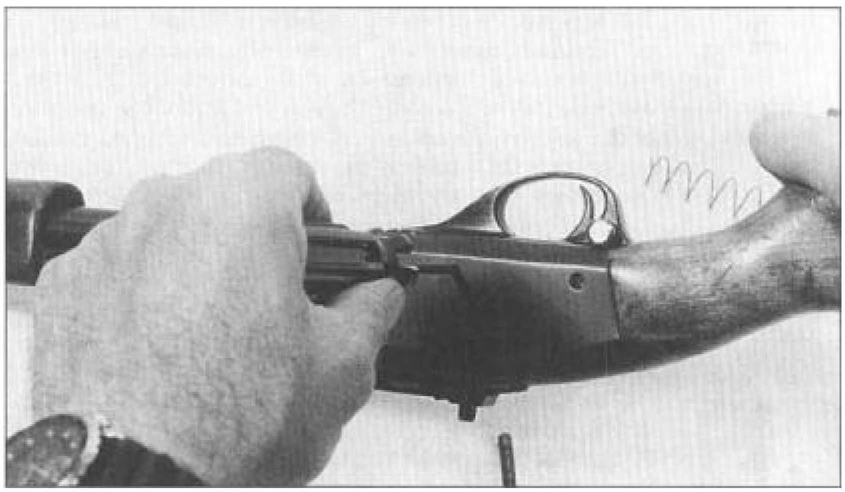
Reach into the bottom of the receiver and press the right shell stop outwards and let the action bars go into the receiver a fraction. (The “right” one is the one closest to the ejection port.) Then depress the left shell stop and push the action bar/forearm back an inch or 2, If you run the action all the way back the action bars will cam the shell stops as they are designed to do. Without the support of the trigger assembly housing and the assembly pins, the shell stops may become loosened over time.



The magazine spring and follower are held in by a nut on the magazine tube. For extra magazine capacity, the nut can be replaced with a tube. To disassemble, unscrew the nut or tube.

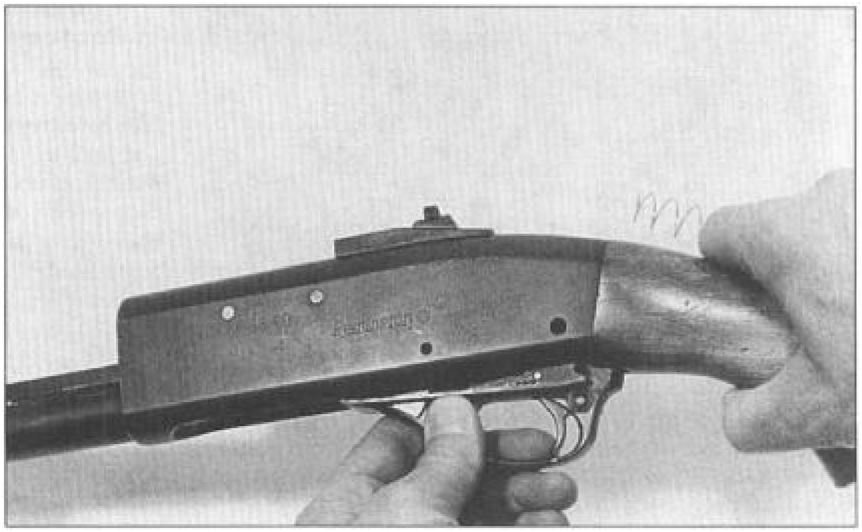
The trigger assembly is held in place by cross pins that are kept in place by spring pressure.

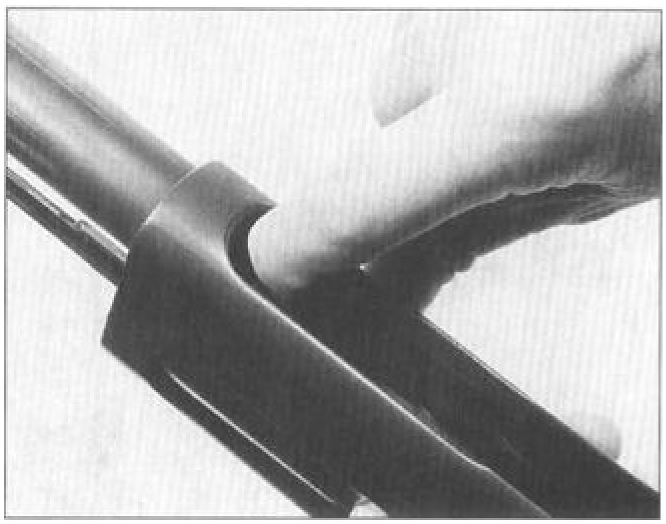




With both pins out, you can remove the trigger assembly.

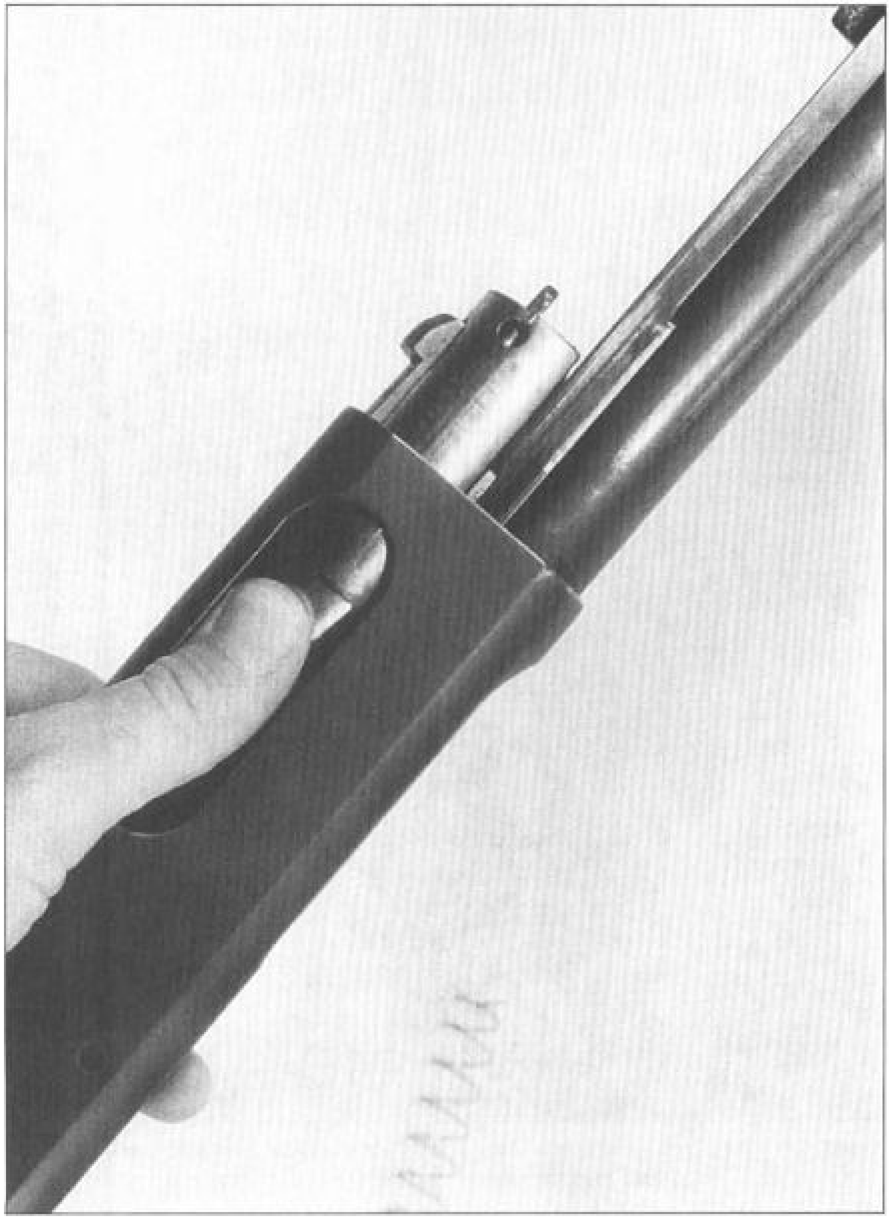
With the pins out, pull the trigger assembly from the receiver.





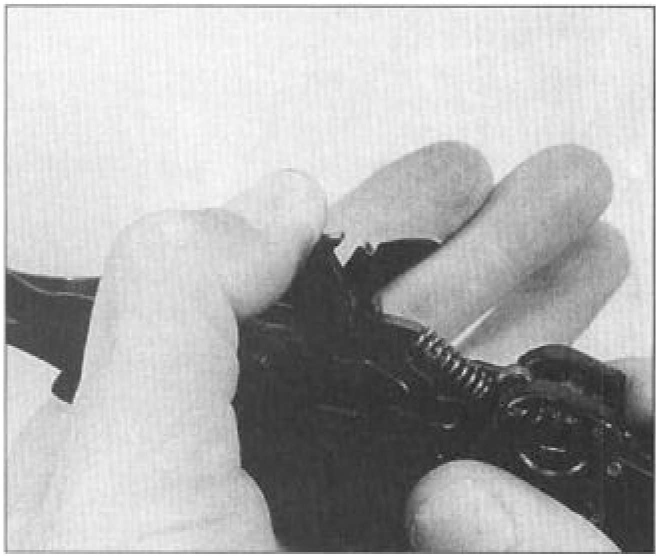
You have to depress the shell stops in order to remove the holt and slide assembly from the receiver.

The bolt, slide plate and the action bars do not stay together of their own accord. When reassembling (or taking them out) you must hold the parts together or they will fall off onto the bench or floor.

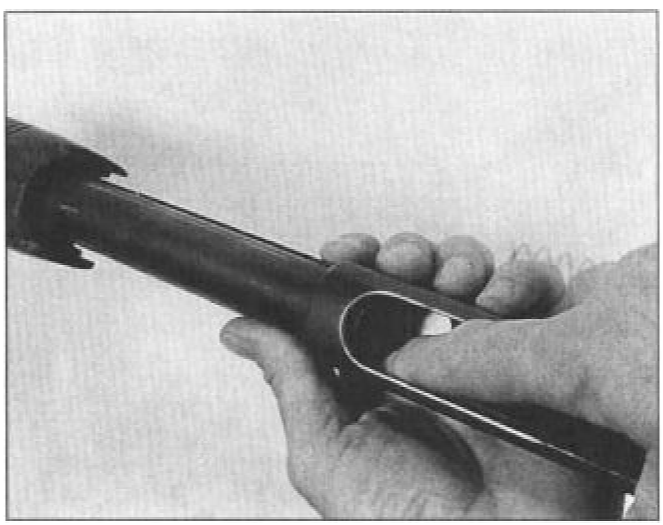


With the shell stops pressed out of the way, the bolt and slide assembly easily come out the front.

To reassemble, hold the bolt and slide assembly together, and insert them into the front of the receiver.



You must cock the hammer before reassembly, or you won't get everything to fit.



Then push the right-hand shell stop into the receiver to clear the action bars.

It can get a little tricky, juggling the receiver, action parts and pressing the shell stop all at the same time.

Insert the trigger assembly. Press the pins through. Then, run the action back and place the barrel into the receiver. Once the barrel is seated and the barrel hanger encircles the magazine, screw on the retaining cap.

Staking The Shell Stops

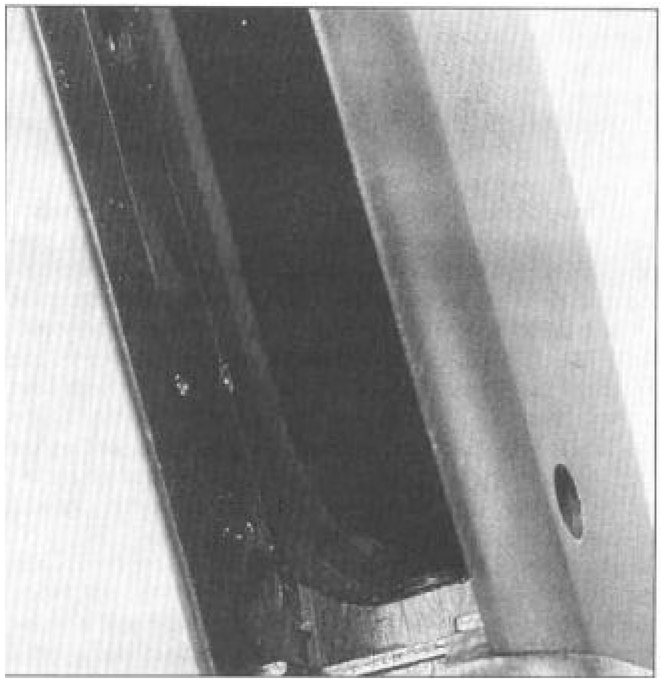
The shell stops in the 870 are two long spring steel strips that rest inside the receiver, one on each side. The rear of the stops are staked into their slots. The front of the stops bear against the shells as they come out of the

magazine. Each stop is cammed out of engagement with the rims of the shells by the recesses cut into the action bars. As the action bar moves back, the initial shell stop holds the next shell in place in the magazine. As the action bar reaches the end of its travel, the second stop is released, bearing against the first shell but behind the rim. The initial shell stop then gets cammed out of engagement, releasing the first shell. The first shell snaps back into the receiver, while the second shell stops against the second stop. As the action bar goes forward, the initial shell stop cams back into the shell path, and the second stop is then cammed out, releasing the now-first shell to rest against the initial stop.

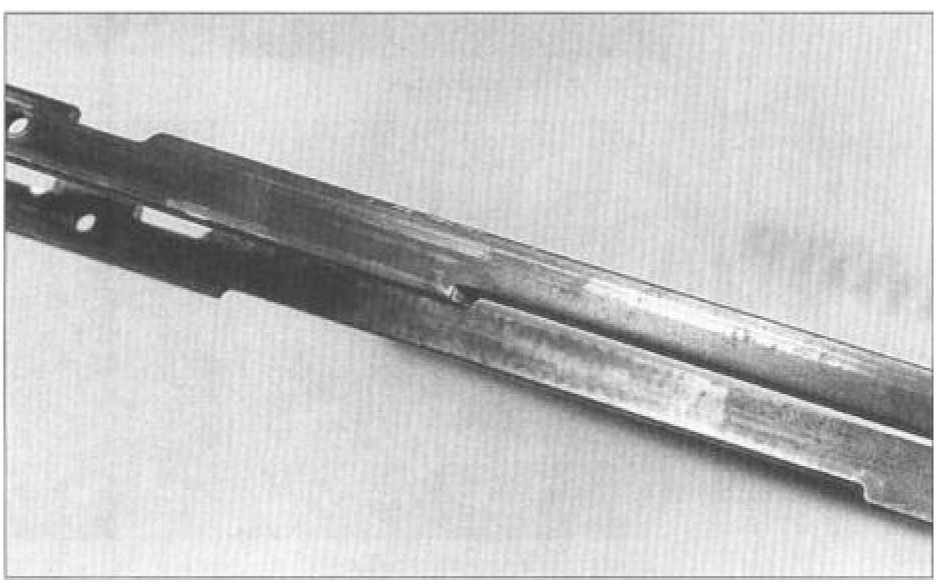
If the shell stops are loose in the receiver, they will not be properly positioned to stop the shells. Pumping the action with loose shell stops usually result in either all the shells trying to come out at once, or none of them.

Staking is easy in concept and a juggling act to execute. To re-stake the shell stops your will need a padded bench, hammer and shell stop staking tool. The staking tool is a horse shoe-shaped tool with a sharp stud sticking out of the bottom. I have read of several pliers-type staking tools, and tried one without success. The steel of the receiver has to be peened to hold the stops in place, and the hammer-tool has worked for me for years.

Make sure it is unloaded, and strip the shotgun down to the bare receiver. Check the shell stops by pressing on them with your fingertips. Loose shell stops will move when you press on them. Properly staked stops will be immobile. If the stops move when pressed, you will have to re-stake them. The shell stops have a hole at the rear through which the trigger housing assembly pin passes. If the stop has shifted, (loose stops can move during disassembly, and even fall right out of the receiver.) push it back in place and insert the assembly pin to keep the stop located.



The shell stops are staked into the receiver at the trigger end. Loose staking means loose shell stops. This can lead to poor feeding.



The notches on the action bars cam the shell stops in and out to feed the shells from the magazine. You can also see the bright spots, where you need to polish for a slicker action.

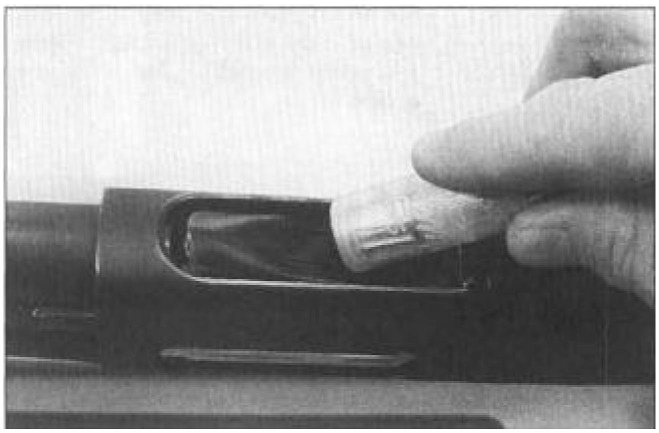
Look closely at the edge of the slot of the receiver. You will see a location where the edge of the slot is dented in. That is the location where it has been peened or staked to secure the stop. Place the receiver on its side, down on the side you will be staking, on your bench. To prevent scratching the receiver, make sure you have a disassembly that or an old towel underneath the receiver. Take the staking tool and insert it into the receiver. Place the point of the tool against the inside of the receiver and move it around until you have located the staked depression. Hold the tool in place with one hand and strike the tool with the hammer. The shell stops are staked in four places, two on each side of the slot. You may have to stake all four, or just one or two. With the first location staked, check the tightness of the stop. If it is not tight, stake the next location.

Once the stop is tight, check the other one for tightness, and repeat the staking if needed.

Sometimes the stops will be too loose to stay down in the slot during staking. They may even fall out. If the stop won't stay in place, you have to do your staking as a two-step process. First, lightly stake the slots with the stop loose or out of the slot. Stake the locations just enough that you cannot press the slop back into the slot by finger pressure. With the slot partially staked, hold the stop against the stakings, and press the tip of the staking tool against the stop. Tap the tool with your hammer and snap the stop into the slot. With the stop in the slot and loosely held by the stakes, you can finish staking the stop in place. Stake the first location, and then use the tool to tap the stop down to the bottom of the slot. Repeat the staking and stop bottoming with the other three locations.

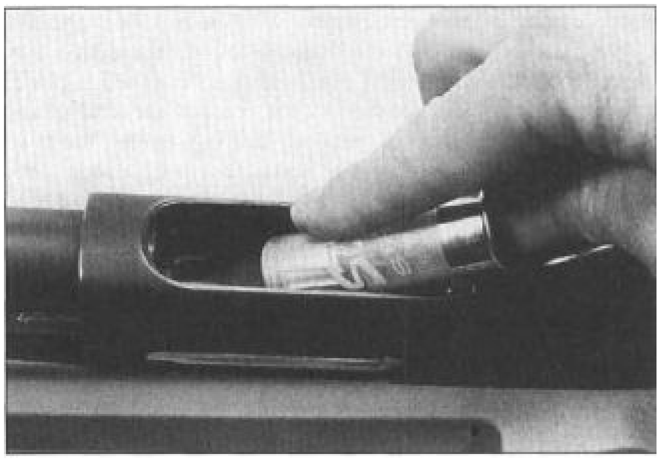
Stops also break. The tip of the stop rests in a recess between the magazine tube and the receiver. If the tips break, the stops cannot rest in their proper relationship to the action bars, and will not feed. Or they will fail to retain shells in the tube at all. A quick look at the tip will determine if it is broken. To remove the broken shell stop (it is too much to ask that a broken one be loose, loose ones don't break, and broken ones are tightly fastened, or so it seems) again strip the receiver. With the receiver held down against your padded bench, work the tip of a screwdriver under the leading edge of the shell stop and then “walk” the tip of the screwdriver back towards the rear of the receiver until the shell stop pops free of the staking. You'll probably have to partially stake the edges and tap the new shell stop down to the bottom of the slot.

A heavily-used 870 of advancing age may have had its shell stops staked into place a number of times. The edges of the slot may be chewed up too much to re-stake yet again. (We are talking of a heavily-used 870 that has been staked a bunch or times, or staked by a sloppy worker) If the slots are too far gone, you'll have to provide new locations to stake. The edge of the shell stops are beveled to accommodate the staking. If you try to stake in a new spot without bevels, the stakes won't hold. The spring steel of the stops is harder than any file you may own. The most effective method of putting new bevels in the stops is with a hand-held grinder and either a sanding drum or cutoff wheel.

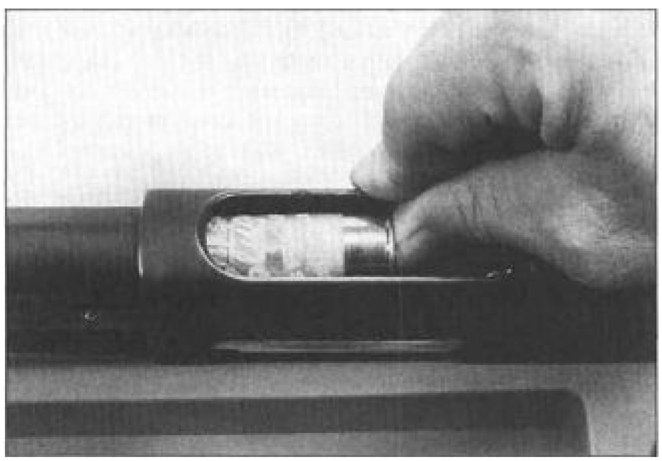


The 870 lifter is always down from the bolt, and you must push it out of the way to load another shell.

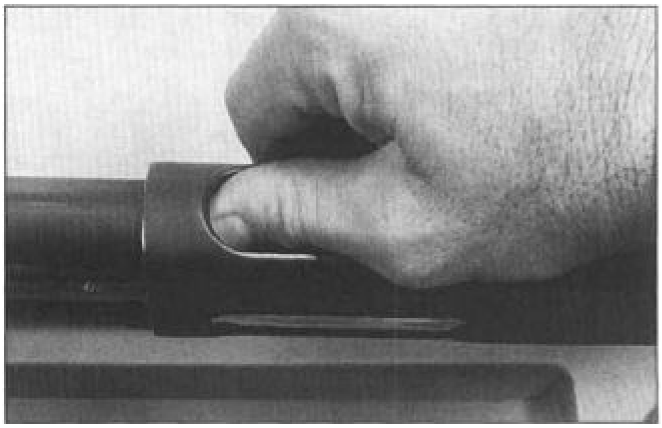
Cut your new bevels right behind he old locations, but far enough from the existing bevels that there is a shoulder of steel on the stop between the old and new ones, and there is fresh steel on the receiver where you can drive your new stake points. Once your bevels have been cut, place the stop in the slot and line the staking tool up to the new bevel. You may have to place a flashlight on the bench to illuminate the area well enough to see. Stake the new locations as you would the pre-existing ones.



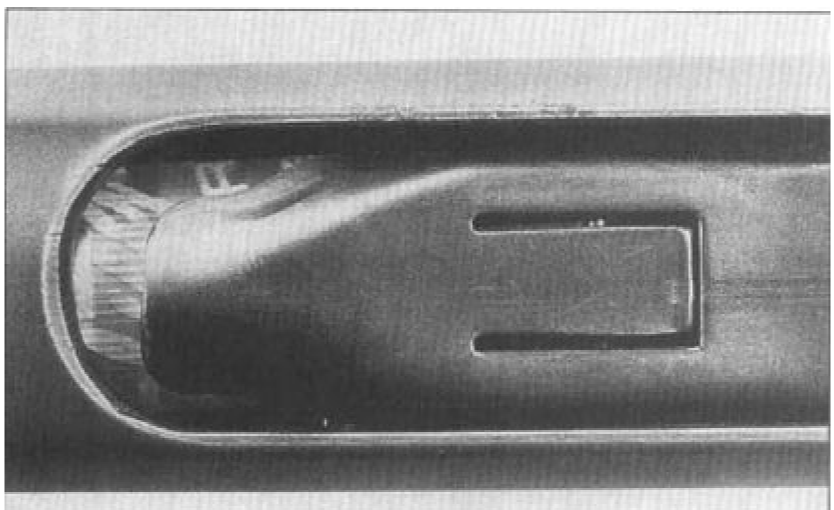
There is no button to press, just push the shell past the lifter…



… into the magazine tube



…and press it past the shell stops.



If you don't press far enough, the shell can pop back under the lifter, jamming the action.

Double Feed on the 870

The 870 suffers from one minor malady that can be a big problem in a defensive shotgun. When you press a new shell into the magazine, you push the lifter out of the way and thumb the shell into the magazine tube. If you do not press the shell far enough forward for the initial shell stop to catch it, the shell will be in a precarious position. It may pop right back out. It might stay in the magazine, held there by the forward lip of the lifter. If the lifter

snaps back down into its resting position, nothing will keep the shell in the magazine. It will pop out of the magazine, and be trapped between the lifter and the bolt slide. Called a double feed, trying to operate the slide on an older 870 so jammed simply wedges the shell tighter against the underside of the slide. In the old days some shooters would cut a slot down the center of the lifter, so in the event of a double-feed they could press the shell back into the magazine with a key or knife blade.

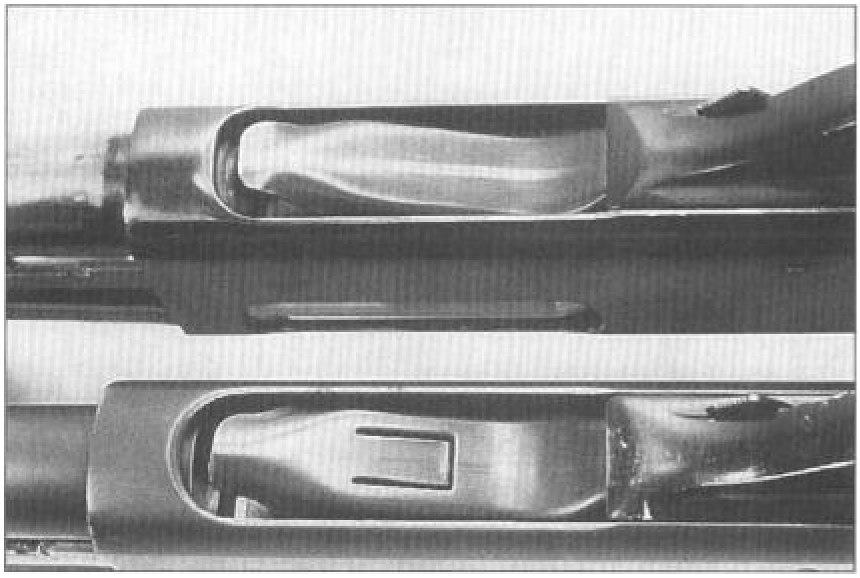
Remington solved the problem by re-designing the lifter and slide. With the new design you simply work the action, free the extra shell, close the action and stuff the magazine full again. Installation of the parts is easy.

Obtaining the parts is not. Some 20 years ago, Remington offered parts kits to Police Departments so their armorers could upgrade 870s. The program has long been discontinued, and the kits are not carried in the Remington parts inventory as a kit. You would have to obtain the separate parts, carrier, bolt and slide. The current cost of the parts is more than $100. It is not cost-effective to upgrade an old 870. If you really are worried about the double-feed problem, trade your old 870 for a new one. (Perhaps not the advice you would expect in a gunsmithing book, but I have to tell the truth.) The trade-in value of your old gun would be more than the cost of the upgrade parts, and the new gun will have screw-in chokes.

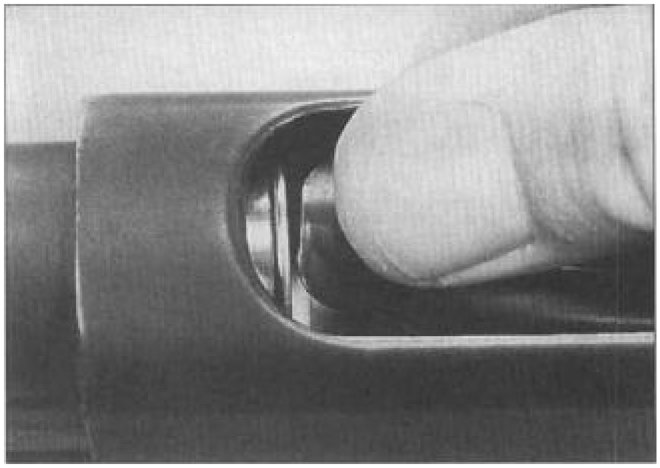
Smoothing the Action

The 870 is an easy action to pump. Compared to an older design, it is quite smooth. But compared to the two actions at the peak, the Ithaca M-37 and the older Remington M-31, the 870 seems a little rough. You can smooth the action and make the pumping slicker and easier. Whether you are shooting doubles in trap or skeet, trying to pick up a pair on game birds, or trying to maneuver through a practical shooting course faster, a smoother action is an asset.

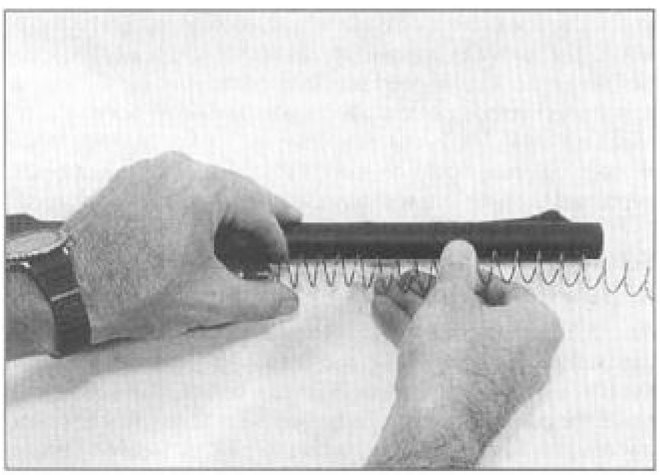
Remington improved the design, and added the anti-bind lifter and other parts. The new lifter, on the bottom, has a U-slot cut into it. A double-feed is easy to correct, just pump the action. On the old lifter, right, a double feed can be cleared only by disassembling the action.



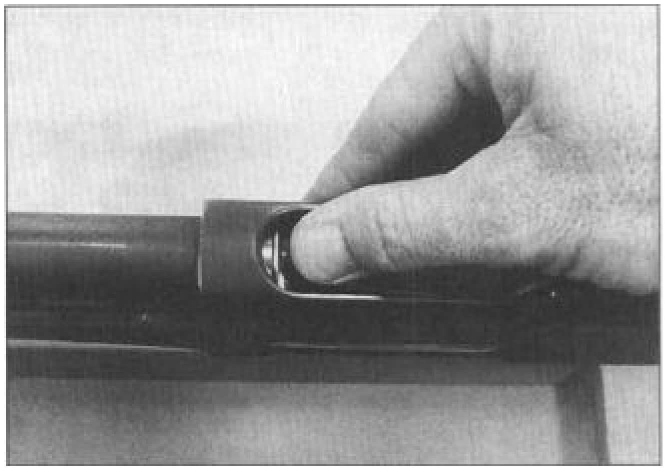
To slick up the action, you will need something to polish with. You can use abrasive stones, abrasive paper backed by a sanding block, or a polishing bob on a hand-held grinder. You will need a set of lubricants afterwards, a synthetic light oil-like lubricant and a super-slick grease. The combination I use is either Break Free or FP-10 as the light oil, and Chip McCormick's Trigger Job as the grease. Make sure the shotgun isn't loaded. Detail strip the action, and put the parts on your bench. Start with the action bars. On the bars you will see the friction points, where the bars rub against the receiver and the bluing is worn. Most of the marks will be on the tops and bottoms of the rails. Polish, stone or power-polish the tops of the rails. On the insides of the rails you will see where the shell stops rub as they are cammed out of the way. Polish the camming edges of the rails, and the section of the rails where the shell stops ride.



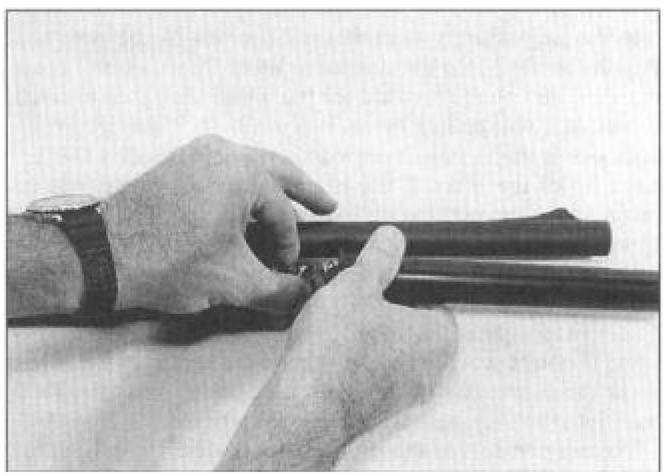
You can see how small of a gap there is for a double-feed to occur. But it does happen, and usually at the most inopportune time.



To install the extended spring, use one hand to keep the installed part compressed, while pushing with the other hand.

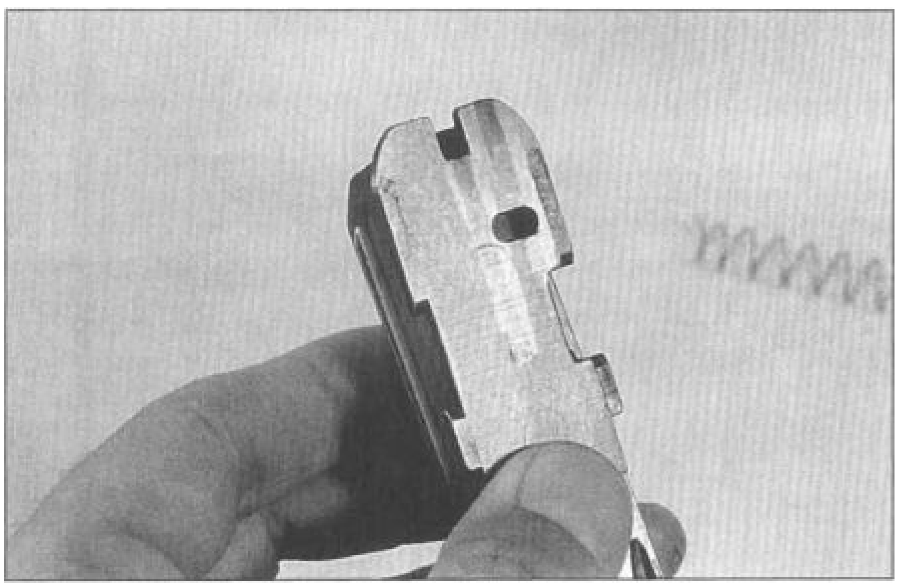


Usually in a double-feed, the shell comes back against the lifter tip and holds there. But if it doesn't, the gun will be tied up until you correct it.



Once the spring is compressed enough, you can use the tube to press it in and screw the tube tight.

The extended tube requires an extended spring which is almost as long as the 870 itself.



The bright track on the bottom of the bolt slide is where the hammer bears against it. By polishing the track, and the face of the hammer, (and a few other places) you can smooth up the action.

When you work the action after firing, the hammer is resting against the bolt. Polish the face of the bolt to reduce the friction of the hammer being cocked. The bottom edge of the bolt slide is the bearing point of the bolt as it cocks the hammer. Polish the center section of the bottom rear edge of the

slide. The only part left is the exterior of the magazine tube. Clamp the receiver in a padded vise with the magazine tube sticking out. Take your abrasive paper or doth in a fine grit (320, 400 or 600) and use it in a shoeshine manner. Polish the areas where the action tube has rubbed the bluing off the magazine tube.

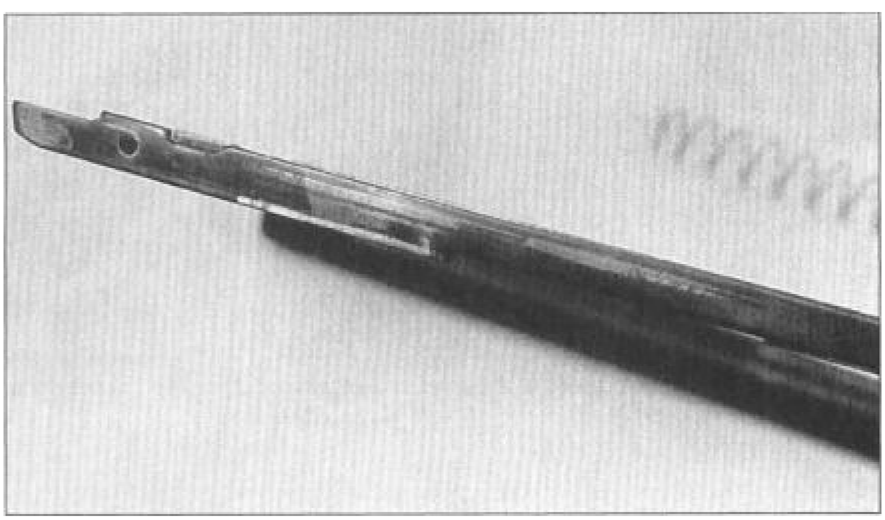
With a round stone or a round polishing bob in your handheld grinder, polish the feed ramp on the barrel. The feed ramp is a small beveled edge on the bottom rear of the chamber. It is often overlooked as a point needing improvement. A sharp edge on the ramp can create drag on a shell feeding up the ramp. Polish the ramp surface and the roll-over edge leading into the chamber. Chuck a ¾-inch diameter (or close to it) polishing wheel in your hand-held grinder and polish the lower (interior) surface of the barrel extension. A shell feeding into the chamber will drag its rim along this surface, and tool marks or sharp edges can create drag.

Scrub the parts to remove any abrasives that might be left behind. Place a small amount of the McCormick Trigger Job on the tops and bottoms of the rails, and rub the grease the length of the polished areas. Also place a small dab of the grease on the pivot edge of the rear center of the bolt slide.

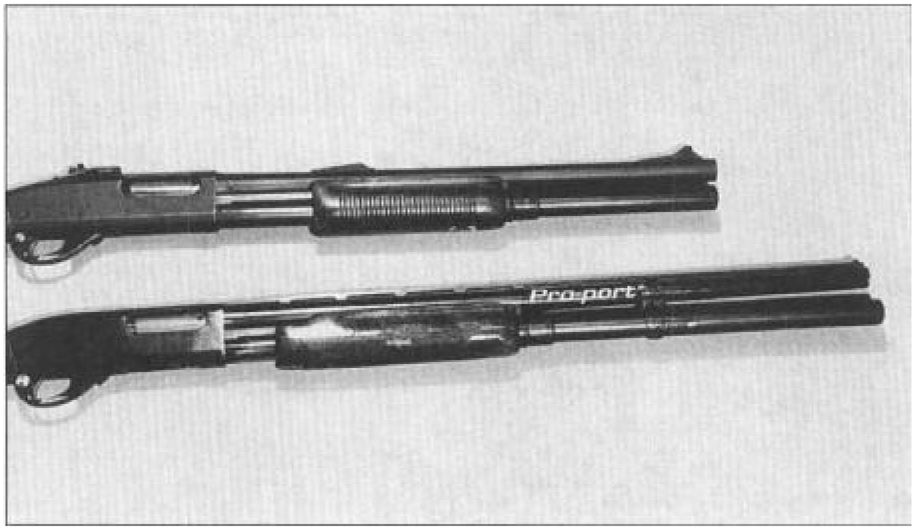
With a patch soaked but not dripping with your synthetic oil, wipe the rails and the exterior of the magazine tube. Thoroughly oil the trigger assembly and the locking lug and firing pin assembly of the bolt.

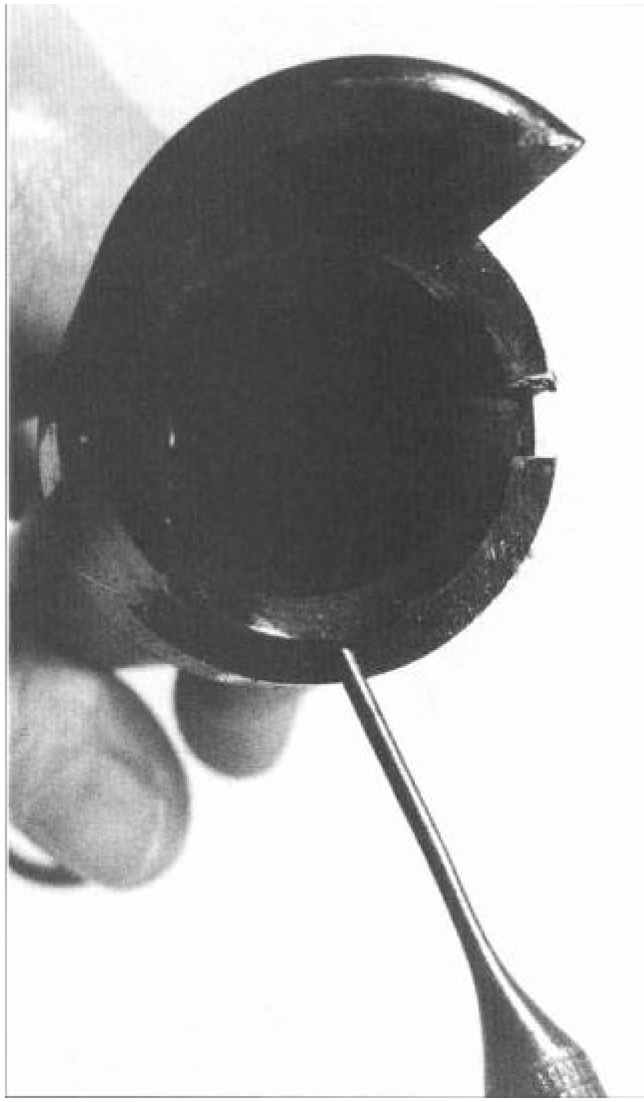
Reassemble your slicked-up 870 and go out and practice on doubles.

The bright spots on the action bars indicate where to polish to smooth the action.



Magazine extensions are customarily the same length as the barrel. No law, just a concern for appearance. Another polishing area is the magazine tube where the action tube rubs on it.





The feed ramp and bottom of the barrel sometimes need polishing. Polish them, and knock off any sharp edges on their joining line.

To reassemble, insert the trigger assembly into the receiver.

Tap the trigger assembly pins into the receiver.

By using cross pins to hold the trigger assembly in place, the Remington designers made everyone's job of cleaning and assembly muck easier.


WILLIAMS

Chapter 16
The Remington 1100 & 11–87

Remington found itself after World War II with a large plant and an old product. While they had been in the business of making self-loading shotguns for many decades, their Model 11 was simply a Browning clone, built under license. Labor and machine costs had gone up during the war, and going back to the old wage levels was not an option. While ultra-reliable, the Browning design required extensive machining and hand-fitting, making it too expensive to produce. In a bold move, the Remington management decided to re-design the line with two ideas in mind. The first was to streamline their shotguns in looks and lines. The second was to increase parts commonality across models. The streamlined looks would catch the eye of shooters, leading them into the 1950s, the decade of the future.

The commonality of parts would reduce manufacturing costs without creating a "cheap" product. The key to the new product line was the receiver and trigger housing. The streamlined receiver was almost identical for every Remington. By making only the last few machine operations different, Remington could shift production from one model to another in record time. The trigger housing was the same for every model, and which model any particular trigger assembly went into, depended on what parts with which it was assembled. From the manufacturing viewpoint, the number of parts to be kept in inventory plummeted. Because of simpler parts, and the reduced number of machine operations to make those fewer parts, costs were cut even more.

The result was the pump 870, and the auto 11–48. The 11–48 was streamlined, and it did have much in common with the 870. But it was still a long-recoil Browning design. Despite its reliability, many shooters felt it kicked too hard for the advantage of self-loading. To soften the kick meant lightening the moving parts, and abandoning the long-recoil mechanism.

The Remington M-11 was just a license-built Browning A-5.

While Remington had made many Model 11's for the War Effort, they wanted something newer for the post- War economy.

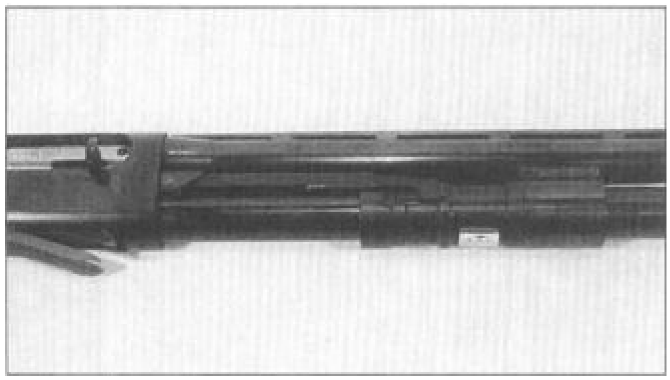
The way out of the long-recoil problems was to use the combustion gases of the shell to power the mechanism. Doing so is not easy. It was impossible at the time John Browning designed the Auto-5 because many shooters were still in the habit of using black powder. Indeed, black powder shells stayed popular until World War 1, when their lack of availability made those who were shooting go with smokeless. After the war, there wasn't much point in loading black powder shotshells commercially. Even using only smokeless powders, the Remington engineers had their hands full. The limitations of a gas-operated shotgun system are that, compared to a semi-automatic rifle (the Remington 740 came out of the same design imperative), the gas in the shotgun is not at as high a pressure, and the operating mass of the shotgun parts is much higher than those of a rifle. While the Browning company worked on short-recoil designs, and Winchester tried several floating chamber models, Remington spent the 1950s developing and marketing a couple of gas-operated shotguns. The Sportsman's Model 58 was first, followed by the 878. While successful and reliable, they still had drawbacks. The 58 has a rotating cap on the end of the magazine, to adjust the gas system between light and heavy loads. The 878 gas system was self-compensating, and could use light and heavy loads interchangeably.

The gas system for each was in the forward part of the magazine tube. That the gas system limited the magazine capacity to two shells was not a big problem. After all, skeet and trap only fired doubles at most, and duck hunting guns can have only a three-shot total capacity anyway. The drawback was that getting the gas system apart for cleaning and maintenance was not easy. A neglected gas system soon lead to a single-shot shotgun, and shooters both loathed difficult cleaning and unreliable firearms.

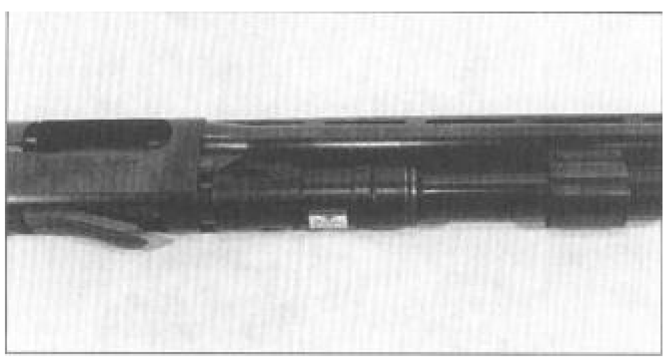
In 1961 Remington came out with the 1100. The gas system rides around the outside of the magazine tube. Disassembly was easier, and maintenance of the gas system became a breeze. The only drawback to the system was the need to correctly assemble the gas rings on the tube. The two steel rings and one rubber “O” ring can be assembled in a grand total of 24 different configurations, and only one of them will work. The good part is that once you see the correct configuration and how it fits, you can easily remember it. The bad part is that many of the other combinations turn the 1100 into a

single-shot, and some turn it into a non-firing section of steel tubing. Correct reassembly solves the problem.

Remington had good-looking shotguns and rifles that cost less than anything else comparable, were easy to manufacture, and every new wrinkle the plant managers and design engineers came up with made them even more profitable to sell. Life was good.



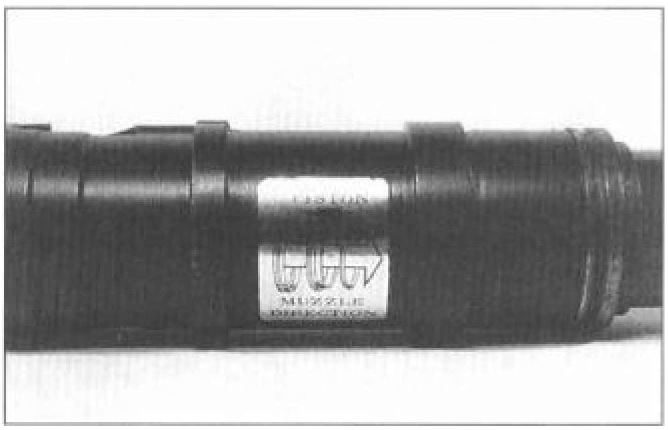
The 1100 gas system encircles the magazine tube.



The action weight and gas rings cycle back each time the 1100 is fired, but nothing enters the magazine tube, as on

For more than 20 years Remington had the self-loading shotgun market pretty much to locked up. Winchester has the 1400, and it is a dependable shotgun, but not as flexible as the 1100. Mossberg worked on various designs, but did not come out with a self-loading shotgun until the Model 9200 in 1992. Both of these are gas-operated self-loaders. Lately the self-

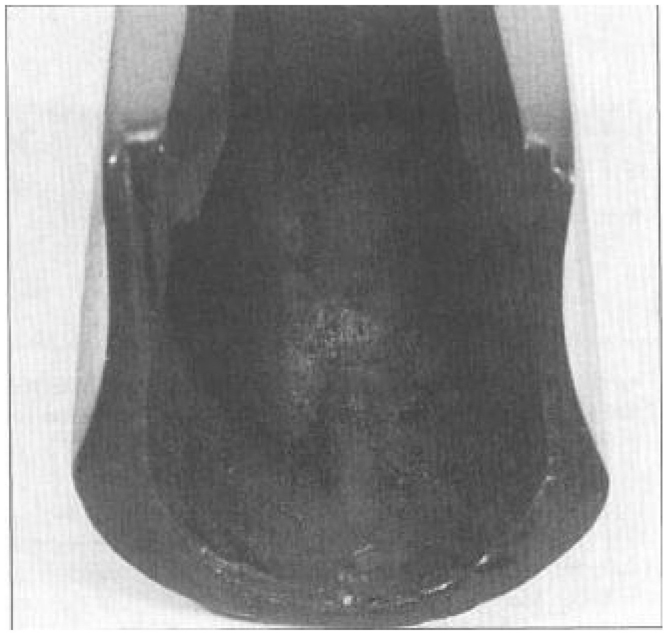
loading market has had a lot of competition from the inertial-mechanism actions. The brand that exemplifies the inertia mechanism is the Benelli. The inertia system works by splitting the bolt into two parts, the locking head and the inertia weight. A heavy spring connects the two. When the shotgun fires, recoil drives it back against the shooter. The spring-loaded inertia weight (riding behind the locking head) is free to react to the recoil on its own. Its inertia keeps it relatively stationary inside the receiver, and as a result it compresses the spring connecting it to the locking head. When the recoil of the shotgun has stopped, the spring pushes the inertia weight back away from the bolt. The spring-loaded movement of the weight then unlocks the bolt, and residual gas pressure blows the bolt open and cycles the action.



Gas ring assembly is important enough that Remington places a sticker on each one. Years of gas residue and cleaning solvent wear them off.

The main and real advantage is clean operation. There are no gas residues to gum up the action. The Benelli is reliable and easy to clean. A Benelli can function long after an 1100 is so grubby it refuses to work. The highly-touted advantage is speed of cycling. The Benelli is supposed to cycle faster than any other mechanism. If you are engaging in high-speed shooting, faster may be better. However, I have been in high-speed shotgun competitions and set several records, and I did not have to wait for my 1100 to finish cycling while setting those records. The big disadvantage to the Benelli is the recoil. In order for the inertia system to work the shotgun must recoil and you must take the hit. If you hang enough weight on a

Benelli to dampen the kick, it will not work. If you drill enough ports in the barrel to soften the recoil, again it won't cycle.



***The 1100 gas system blows powder residue all over the place. Here is a forearm after shooting*.**

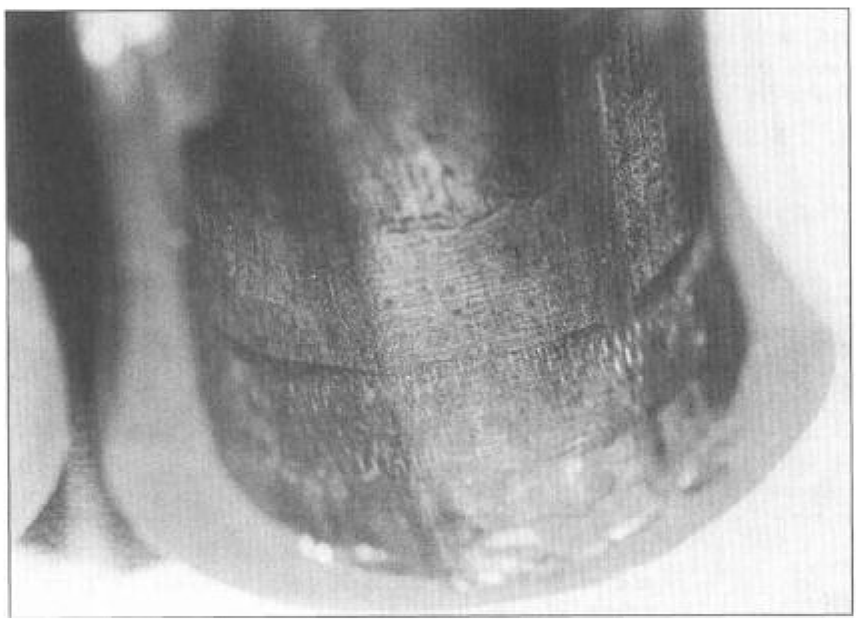
If and when I feel that I am out-stripping the cyclic rate of an 1100 or 11–87. I will look into an inertial-recoil shotgun. Until then I'll gladly shoot the softer-recoiling gas-operated gun.

The reliability of a properly-cleaned 1100 is plenty good. When my brother, Mike, and I went through the Gunsite shotgun class, we showed up with 1100s in a class predominantly filled with 870s. (There were a couple of Benelli's, but they both choked so badly on the first day that their owners switched to 870s.) The instructors expected us to spend lots of class time working on our malfunction drills, clearing our recalcitrant gas-operated guns of their stoppages. Instead, we spent a few minutes at lunch, and after class at the hotel room, cleaning the gas systems of our 1100s. We went the week without problems. One of the assistant instructors was a retired Navy SEAL, and he was impressed with our 1100s performance, and curious enough to find out how such a thing was possible. He tracked us down during one lunch break, finding us on the range with our shotguns spread out on the range benches, wiping things clean. If you want to keep your 1100 (or 11–87) running without problems, keep the gas system clean. Also,

keep a few spare parts on hand. Keep in your cleaning kit or travel bag a small box with: a spare O ring or two, a couple of the trigger assembly D rings, an operating handle and some paper towels to keep the gas system wiped out.

Disassembly

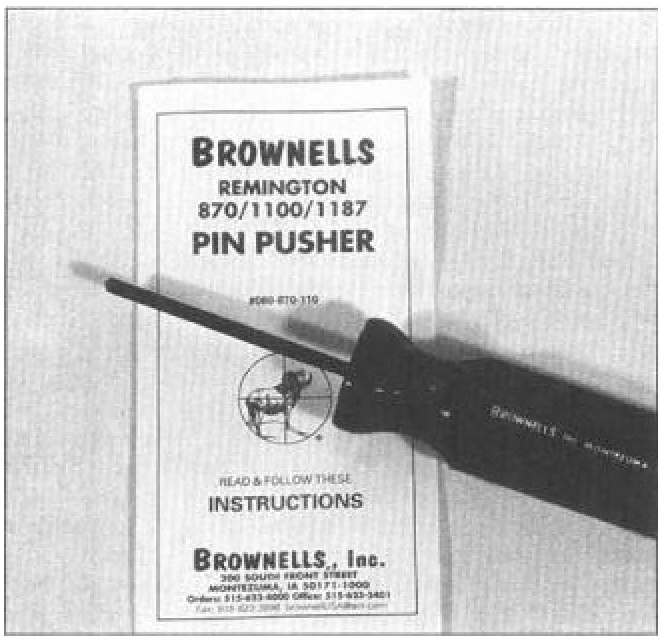
First, make sure it isn't loaded. Lock the action open. Unscrew the magazine nut. Pull the forearm forward off the gas system. Slide the barrel forward off the magazine tube. If your 1100 is really dirty, you'll probably have the gas rings trapped inside the barrel hanger. Deal with them later. If they stay on the magazine tube, pull the “O” ring off first. Then slide the two steel gas rings off.



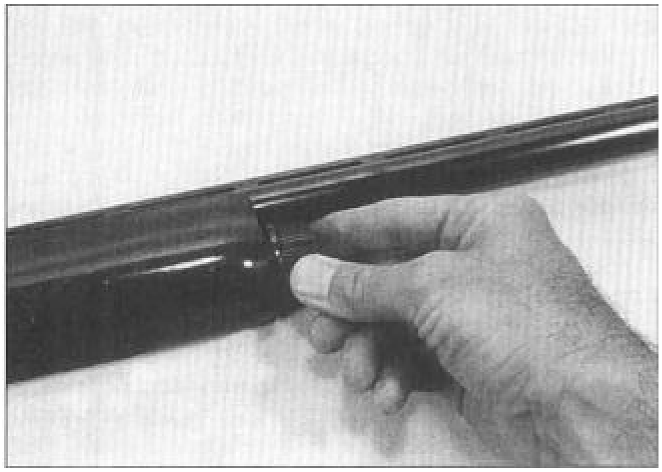
Here is the same forearm after cleaning, showing the reinforcement that has been added to it.

With one hand, restrain the operating handle, and with your other press the release button in the middle of the lifter. The action will want to go forward. Ease it to its forward location. Grasp the operating handle and pull it straight out to the side. Run the action mechanism forward off the magazine tube. The bolt is not attached to the action slide, and may fall off if you are not careful. Press the trigger assembly pins out of the receiver and pull the trigger assembly out of the bottom of the receiver. While the gas

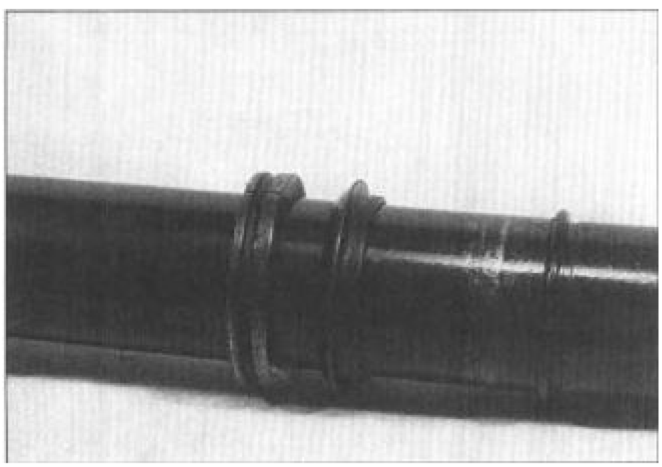
system of the 1100 does not introduce combustion gases into the receiver (as the AR-15 does, for example) the powder residues of the shell are pulled back into the receiver each time an empty shell is extracted and ejected. With a load that burns dirty, the trigger mechanism can come out of the receiver coated with powder residue. It will require soaking and scrubbing to get clean, and a thorough oiling before reassembly. The last part to come out is the action fork. The action fork is the connection between the bolt and the action spring. To remove it, turn the receiver upside down. Reach into the receiver with a pair of needlenose pliers and grasp the rear of the fork. Compress the legs and pull them out of the action spring cap and towards the front of the receiver. Once free, turn it to the side and lift it out of the receiver.



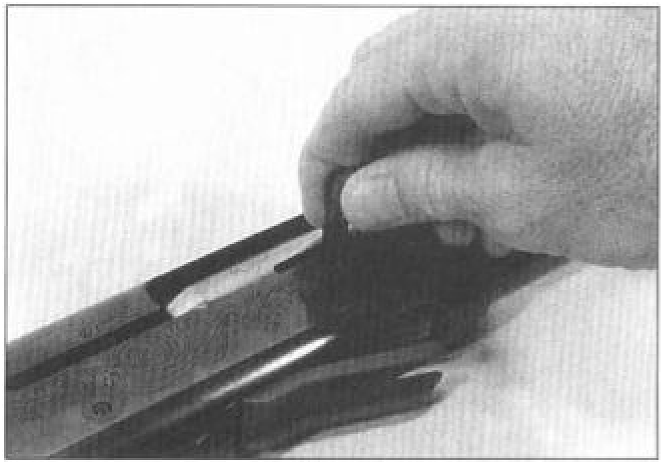
The Brownells pin pusher makes taking the 1100 apart much easier.



The forearm cap keeps the barrel on, and the gas system in place, and locks the forearm down.

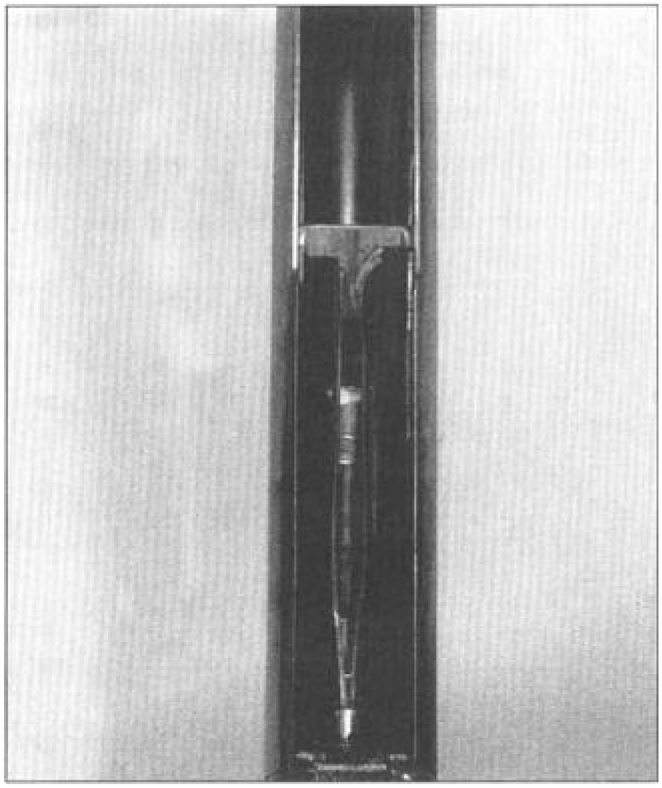


With the muzzle to the right, you see the proper gas ring stacking. The bevels on the two rings meet, and the rubber O-ring is towards the muzzle.

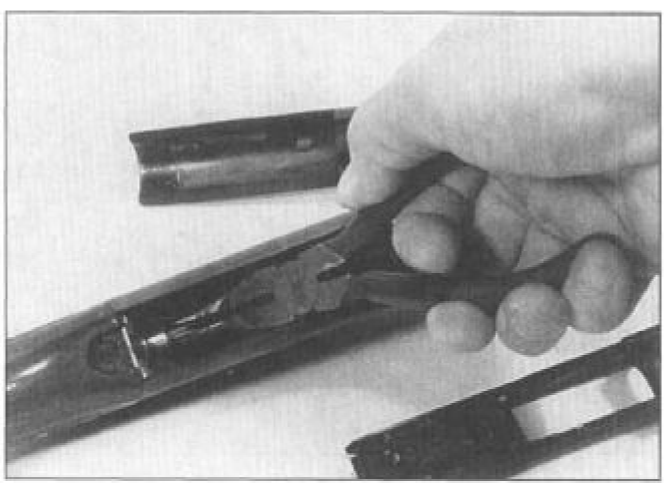


The operating handle is held in by spring pressure.

With the pins out, pull the trigger assembly out.

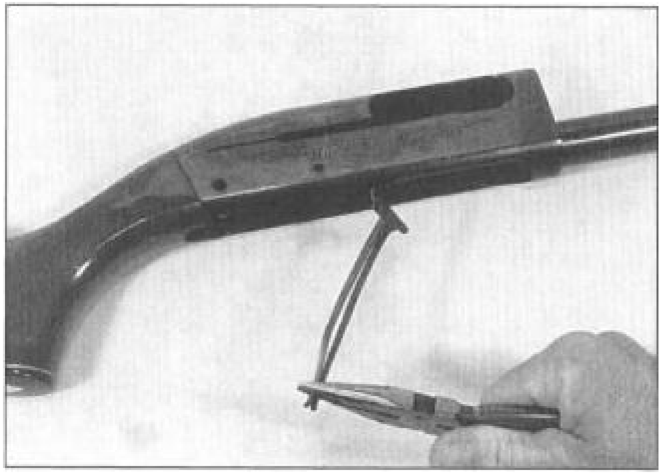


The action fork is the last thing to come out.



Grab the ends of the fork with a pair of needlenose pliers, and compress the legs.

Reassembly

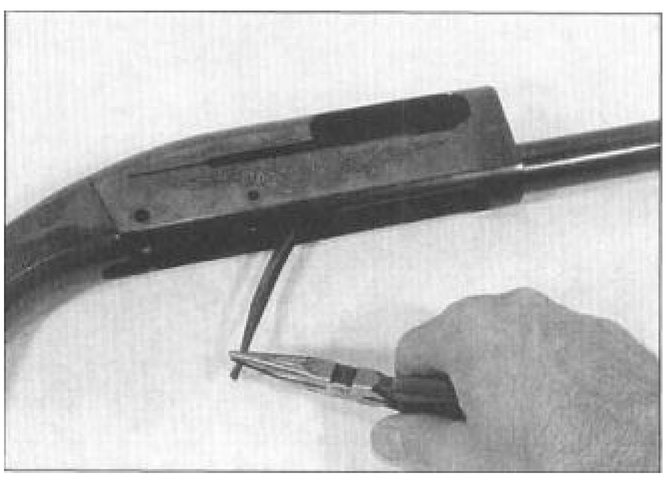


To reinstall, turn the fork sideways in insert into the receiver to its track.

The 1100 is simple but a bit fussy to get back together. Once clean, insert the action fork. Take the fork and turn it sideways and lower it into the receiver. Turn it to insert the edges of the front into the slots of the receiver. Make sure the curve of the legs is up towards the top of the receiver. With your needlenose pliers squeeze the ends of the legs together and insert the feet into the opening of the action spring cap. Place the bolt on the rear plate of the assembly. Slide the bolt and assembly over the magazine tube. Start the action into the receiver. It will stop against the flat shell stop. Reach in with a fingertip and press the stop clear of the action bar. Once the bolt is in the receiver far enough, insert the operating handle into the bolt. Slide the gas rings onto the magazine tube in the correct order, followed by the O ring. Before you install the barrel, make sure the barrel support clip is in the receiver opening. The clip is the sheet metal piece that clatters along the rails of the action assembly. The clip may not look like much, but it acts as a wedge to keep the barrel properly positioned in the receiver. Without it your 1100 may become unreliable, failing to feed a shell into the chamber. Slide the barrel over the magazine tube, then replace the forearm. Tighten the magazine cap in place. Finally, insert the trigger assembly. The action lock lever sticks out of the side of the assembly, and rests inside a recess in the receiver. Tilt the assembly towards the lock lever and insert the lever

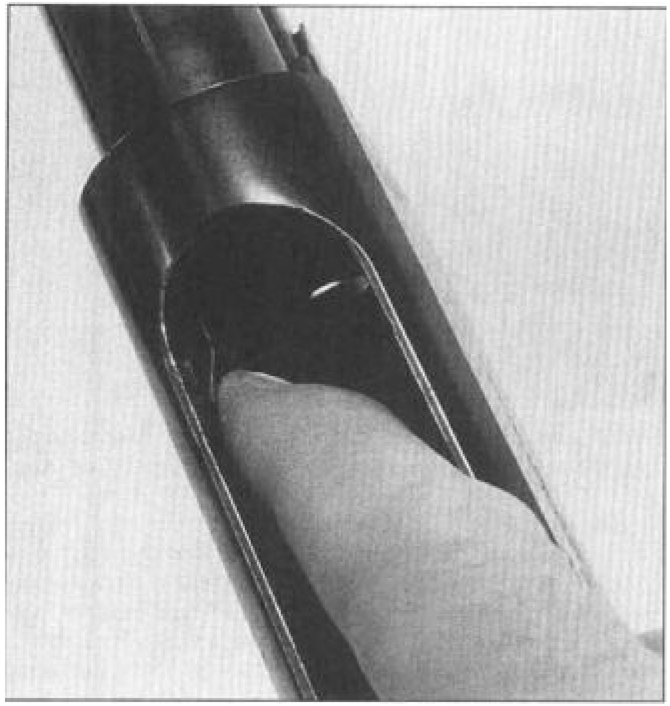
first. Then straighten out the assembly and press it into the receiver. Once the holes line up, press the assembly pins through until they are flush.

For the nearly two decades I spent fixing other shooters shotguns, I saw many 1100s and fewer 870s. The 870s did not come into the shop until something was actually broken. I saw 870s with broken stocks, missing extractors and bent rails binding the action. To stop an 870, something had to be busted, bent, wrecked or knarfed to keep it from working. And the same is true of other pumps, too. 1100s poured into the shop late each summer and early each fall with nothing broken, but not operating. The difference was the gas system, and the lack of maintenance. On a pump, the shooter is the operating mechanism, and unless you are built like the Incredible Hulk you can't hurt a pump by working it “too hard.” If it gets crusty from lack of maintenance, you just pump a little harder and the action works the same as it always did. On the 1100, there is only so much gas to work the action. You cannot generate “a little more gas” to work the mechanism if it starts to get a little sluggish. Many hunters and shooters would put their shotguns away at the end of their season and not pick them up again until a few weeks before it was time to start assassinating ducks, geese or pheasants. By then the powder residue had hardened like concrete, and the oil had evaporated. Some would even have rust forming.



Then turn it in line, and swing the legs up to the recoil spring cup.

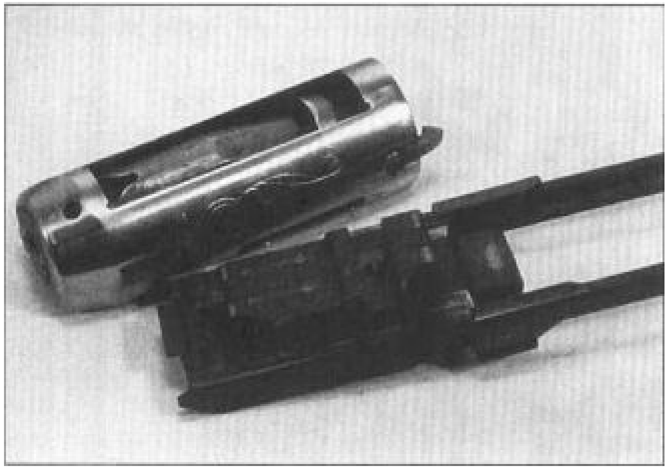
With some basic maintenance, even hard-working shotguns will keep on launching payloads into the sky.



***Press the shell stop to remove or install the bolt and action bar assembly*.**

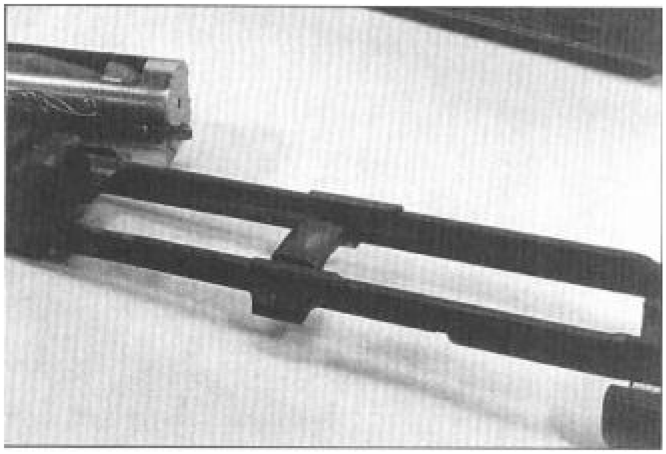
In all the years I spent getting 1100's to work, the first thing I looked for was proper ring stacking. Then I would check to see if the gas system was crusty, then I would see about shell stop security. If your 1100 or 11–87 suddenly decides it won't fire, or won't feed the next shell, you should check the same things in the same order.

The combustion gases in the 1100 push the wad and shot ahead of them. When the wad passes the gas port or ports, some gases seek escape through the gas system. Having fled the onerous chore of pushing a lead or steel payload, they find themselves instead pushing a set of pistons. The pistons on the 1100 are two, and a rubber O ring completes the set. (Without the O ring, many 1100s will not cycle except with heavy hunting loads.)

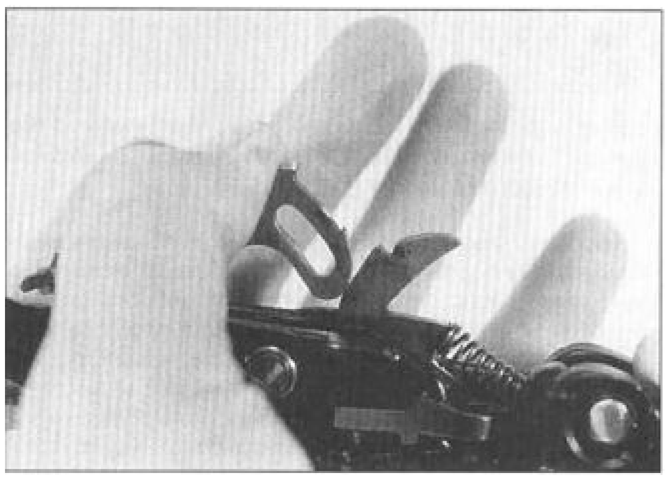


The 1100 action bar is closed at its rear, and the shelf provides the working surface for the holt.

The rings fit and work properly in only one of 24 combinations. In order from the slide weight forward: you want the square ring, the scalloped ring and the O ring. From the outside the square ring looks just that, square. If you look at its inside circumference, you will see that one edge is beveled. The flat side goes against the slide weight, and the bevelled edge goes towards the muzzle. The scalloped ring has a beveled side and a curved side. The bevel of the second ring fits into the bevel of the first ring. The O ring comes last. Of the stacking permutations, some will stack thick enough to keep the bolt from fully closing. The safety dimensions built into the receiver prevent its firing with a partially-closed but not locked bolt. Other permutations will stack thin enough to let the bolt lock, but it won't cycle because of an insufficient gas seal. A missing or broken O ring will keep the 1100 from cycling with light loads, but some shotguns will cycle with heavy loads even without the O ring.



The barrel support keeps the barrel securely positioned in the receiver. Without it you can have a cranky 1100.

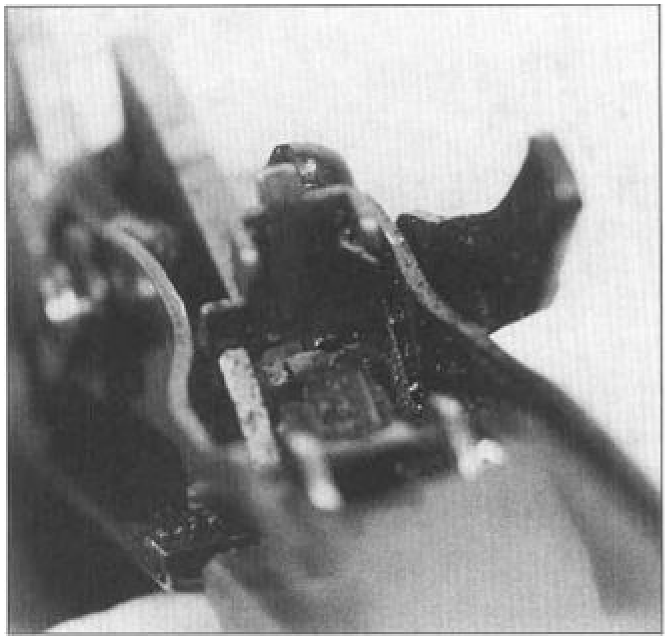


The 1100 has to be cocked to disassemble and reassemble. Cock the hammer and put the safety on to work with the Remington 1100 or 11–87.

Care of the Gas System

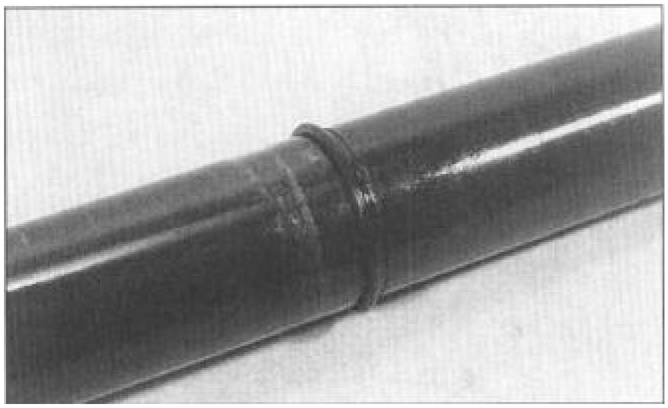
All of those combustion byproducts used to cycle the mechanism have to go somewhere. What they end up doing is settling down to retire on your magazine tube, gas rings, the barrel hanger and the interior of your shotgun's forearm. On the forearm they do no harm. Everywhere else they

gum up the works. Once you have your 1100 apart, cleaning is a simple if messy affair.



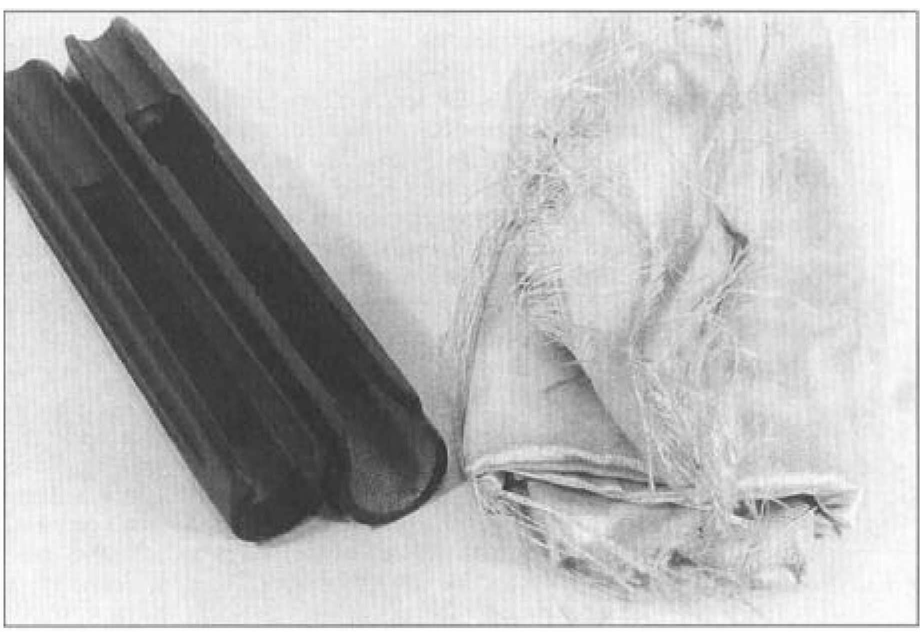
Even after just a little shooting, the trigger assembly of this 1100 has become coated with powder residue and unburned powder. Scrub it clean and the gun will be happy.

Wipe the magazine tube clean. If the powder deposits are particularly heavy, or have dried and hardened, there will be deposits you cannot simply wipe off. The stubborn deposits can be scrubbed off with a fiber cleaning pad such as a Scotchbrite® pad or a section of 0000 steel wool. Once the tube is clean, look at it closely. Is the surface of the steel smooth? Or have the years of use and moisture caused corrosion? At my commercial shop we referred to a slightly-corroded magazine tube as having “the crusties.” A light layer of corrosion can cause enough drag on the operating parts that it will just barely work. Once crusty, the slightest increase in drag or decrease in power (cold weather congealing oil or decreasing shell power, powder residue build-up, light skeet loads, or a build-up of residue in the gas port or ports) will turn your 1100 into a single-shot.



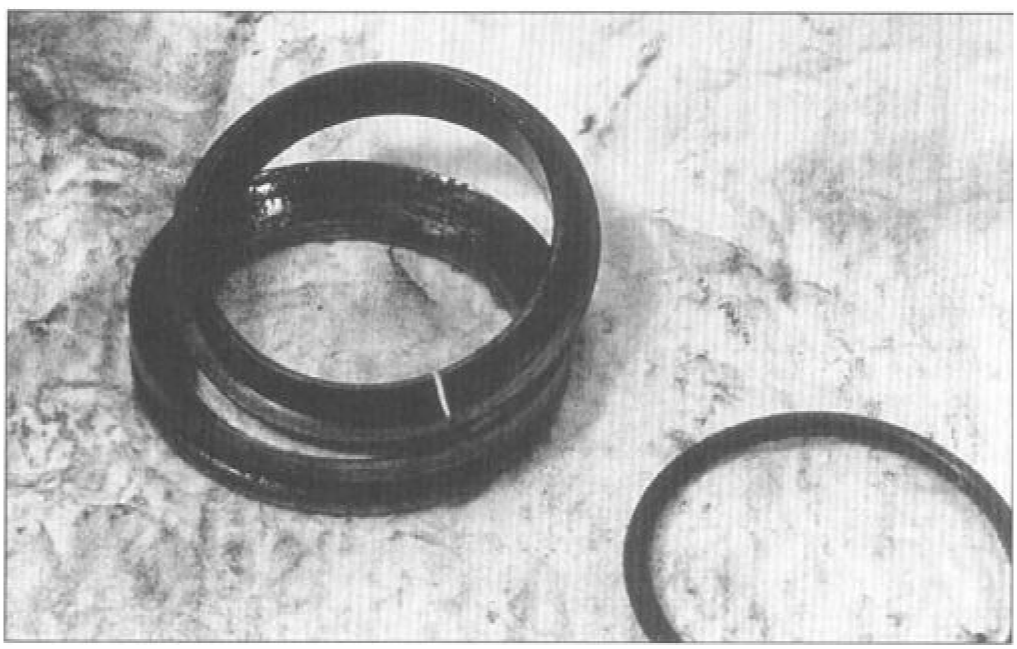
Without an O-ring, your 1100 may become a magazine-fed straight-pull bolt action shotgun. That is, it won't feed itself.

The steel wool or cleaning pad may be enough to scrub the corrosion off. The easiest way to buff the tube clean is with a power wire wheel. On 1100's, the tube is carbon steel, and blued with the rest of the shotgun. I would buff the tube until it was bare steel. If you do not have a wire wheel, then a section of 600 grit abrasive cloth works well. Wet-sand using oil or mineral spirits, and sand in a shoeshine motion completely around the tube.



Any shotgun forearm on a self-loading shotgun is a hollow shell. Fiberglass and epoxy reinforcement become necessary when the gun receives hard use.

In cases of heavier corrosion, where the surface of the tube is pitted, you must polish the tube, but not polish out the pits. Use your 600 grit cloth (again in a shoeshine motion) to polish the pitted area, but only to bring the unpitted parts to a smooth surface. By polishing over the pitted area you provide a smooth surface for the gas rings to slide over. If you were to polish the pitted section down to smooth metal, you will create a dished area. Not only will you be thinning the wall of the magazine tube, you will create a gap for gas to blow by, cutting down on gas system efficiency. The gas blowing past the rings, through the dished areas you have polished smooth, will decrease the gas system's operation. One of the improvements of the 11–87 was to change the magazine tube to one made of stainless steel. While “stainless” is much slower to corrode, it will rust. You may not be faced with the need to polish the tube from corrosion, but you should still wipe it clean and burnish it smooth with 0000 steel wool.



Being in the direct path of the gases, the gas rings get really dirty. Wipe them off every time you clean the shotgun. If they get really cruddy, steel

The rings on the 1100 provide a seal against the gases. The two bevels of the rings working against each other seal the rings against the magazine tube and the barrel hanger. As they are clamped together between the gases and the slide weight, the first ring expands slightly to seal against the barrel hanger. The second is compressed to seal against the magazine tube. The buildup of powder deposits interferes with sealing the gases, and creates friction. If you have been treating your 1100 properly, when you pull the rings out of the shotgun they with be a sticky, lubricated mess of powder residue and oil. Wipe them clean. If they are heavily caked, soak them in a small dish of Nitro solvent and scrub with 0000 steel wool and wipe clean.

In extreme cases, the powder residue will be caked, baked and crusted on so heavily that steel wool will not scrub them clean. There may even be rust. The solution is rotary power. Brownells carries ultra-fine wire wheels that will fit into your hand-held grinder. You must degrease the rings before brushing them clean, or risk splattering oil-soaked powder residue all over yourself, your clothes and the furniture. Use an aerosol degreaser. Spray the rings and let them air dry. Repeat until the rings are bone-dry. Put on your protective glasses, ear muffs and face mask and use the wire wheel to buff the crusted-on powder residues away.

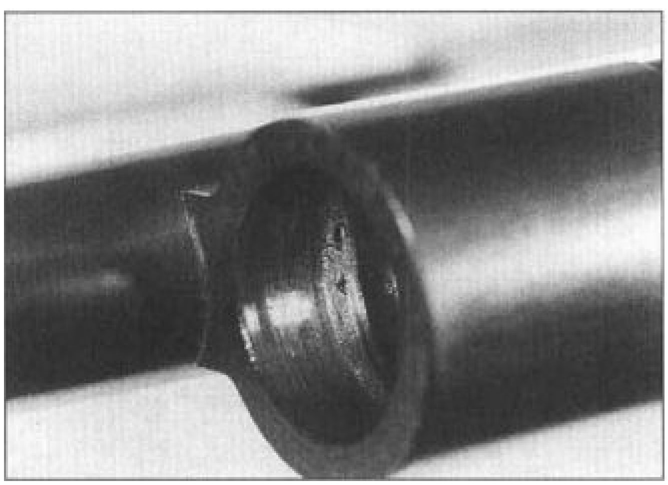
In extreme cases of crusty residue and rust, you'll have to degrease the rings and then buff them with a wire wheel in your hand-held grinder. Really rusty rings may require an extra-fine abrasive polishing wheel.

The last part of the gas system to clean is the barrel hanger. The hanger is the tube brazed to the bottom of the barrel that slides over the magazine tube. It keeps the barrel on, acts as a seal for the gas rings, and is the location of the gas ports. Treat the hanger the same way you treated the magazine tube. If all the magazine tube needed was to be wiped down, then wipe out the inside of the hanger. If you had to scrub the tube, then scrub the hanger. If you had to wire brush the gas rings, you will have to do the same to the interior of the hanger. As with the gas rings, thoroughly degrease the inside of the hanger or you will find yourself splattered with oily powder residue. To wire brush the hanger, clamp the barrel upside down in a padded vise with the chamber end pointing up at an angle. Get your flexible lamp down to the hanger, and watch closely as you buff the powder deposits off. Once they have been scoured away, wipe the interior clean with a cloth or towel.

On really disgustingly crusted and rusted 1100s, I have even resorted to using a brake hone on the inside of the slide weight. While most shotguns only need to have the tube of the weight wiped out, some showed up in such a state of neglect that the weight had to be buffed clean on it's inside to remove powder residue and rust. One in particular was a skeet-barreled 1100 that had been used in a skeet league for each warm weather season for 10 years, without so much as a strip and clean. It finally had had enough of

this abuse, and spat out its extractor. The owner told me “while you're at it, clean it up, too.” The barrel was rusted so heavily between the hanger and the magazine tube, and the barrel extension in the receiver, that I had to clamp the barrel in a padded vise and brace my foot against the bench to pull it apart. At 220 pounds and 6 feet 4 inches, I can pull pretty hard, and for a few seconds it looked like it wasn't going to budge at all. It finally came free with a painful screech and a puff of rust. The O ring was gone, the gas rings were chipped and had sections missing. Various internals were so rusted they would need to be replaced. When he saw the estimate to repair it, the owner exclaimed “I can buy a new one for that much.” Don't let this happen to you, attend to your 1100.

The last part of cleaning the gas system is the gas port or ports. Remington has made barrels in a wide selection of lengths and chamberings through the decades. The port size that would be appropriate for a skeet barrel (1 ounce of shot at 1,145 feet per second, and the least amount of powder necessary) will be too large for a duck barrel of the same length (1-½ ounce at 1,300+, powder weight not critical so long as it brings down a duck.). The skeet load will not cycle the gun when fired in the duck barrel, and the duck load will beat the gun up if fired in the skeet barrel.



This is the front of the gas hanger, showing the gas ports. The hanger gets as dirty as the gas rings and magazine tube. Occasionally the ports must be cleaned.

Cleaning out the gas port or ports is a delicate operation, and not one you need to do with any regularity. At one point I was heavily practicing with

my 1100s for several competitions and I would fire around 7,000 or 8,000 rounds (mixed birdshot and buckshot loads) through one shotgun and several thousand slug loads through another. I would clean out the gas ports annually, almost as a matter of routine. There are skeet and trap shooters who shoot much more than this. If your 1100 is working slowly or intermittently, a plugged gas port is the last thing to check.

With the kind permission of Brownells, I have reprinted their gas port diameter chart. Use the port size as a guide to ordering the correct-diameter drill from Brownells. Do not use a larger drill to open up your gas port. If something is mechanically wrong with your 1100, opening the gas port to "solve" the problem will just beat the gun up.

Clean the ports by hand, using the correct size drill and pliers or drill as a holder.

Gauge/Chamber	Barrel Length/Type	Drill #
12 2-¾″	22″ thru 34″	47
12 2-¾″	Skeet	44
12 3″	30″ Magnum	52
16 2-¾″		48
20 2-¾″	22″ thru 26″	48
20 2-¾″	26″ & 28″ Lt. Wt.	51
20 2-¾″	26″ & 28″ LT-20	51
20 2-¾″	Skeet LT-20	51
20 3″	LT-20 Magnum	52
28 2-¾″		51
.410 2-¾	Skeet	53
.410 3″		51

To clean the port, you'll need a variable speed drill and a drill bit of the correct size. Clamp the barrel in a padded vise with the muzzle pointing down, and the barrel positioned so you can brace your hands on the vise. Tighten the bit in the drill chuck so the tip of the drill will just clear the inside of the bore just before the chuck would hit the hanger. Leave the drill unplugged. Yes, no power. The gas port is drilled at an angle to the bore. Brace your hands against the vise, get the tip of the drill started to the hole. As you press forward, the tip of the bit will try to wander out of the gas port (the port is drilled through a slanted surface, after all) and you must keep your hands braced so you can guide the drill. Once the chuck is almost touching the edge of the hanger, pull the drill out. Brush the inside of the hanger and the bore clean.

Why not use power? The sides of a drill are hard, and the edges sharp. If your hand wobbles slightly while drilling (everyone's does). By using the drill as a holder for hand-reaming you prevent the inadvertant opening of the gas port. Hardened powder residue is a gritty and abrasive substance. If you want to ease the work on the drill bit by putting a drop of oil or bore solvent onto the gas port, go right ahead.

If you aren't going to use power, then why all this tolderol using the vari able-speed drill? Because it is the easiest way to hold onto the drill bit. Using your fingers is not fun, and a pair of pliers are not proportioned to properly hold a drill. If you happen to have a holder for the correct drill bit,

use that instead. One of the things I should have done before retiring was make a gas port drill holder. A few minutes with a lathe and some aluminum bar stock, and I wouldn't have to fool with the drill. If you have access to a lathe, make one for yourself.

For reassembly, some old traditions must go by the wayside. I don't know about your area, but in Michigan many hunters and shooters feel compelled to hold to the tradition of leaving the 1100 gas system dry. I have heard a number of reasons ("the dry residue breaks up each time you shoot," "oil will gum it up and form an abrasive," or "in cold weather the oil solidifies and the gun won't work.") but the end result is the same: rust. Rust stops shotguns from working. Use a synthetic oil like Break Free. Rem Oil or FP-10. Give the magazine tube, the inside of the action weight, gas rings and the inside of the hanger a light coating and then reassemble.

The Action Tube, Nut and Spring

Disassembling the 1100 hardly ever calls for removing the recoil spring. However, in the course of repairing or refinishing the stock, you'll have to remove the stock. If you are going to polish the receiver before sending it off for rebluing, the wood has to come off. Prepare yourself.

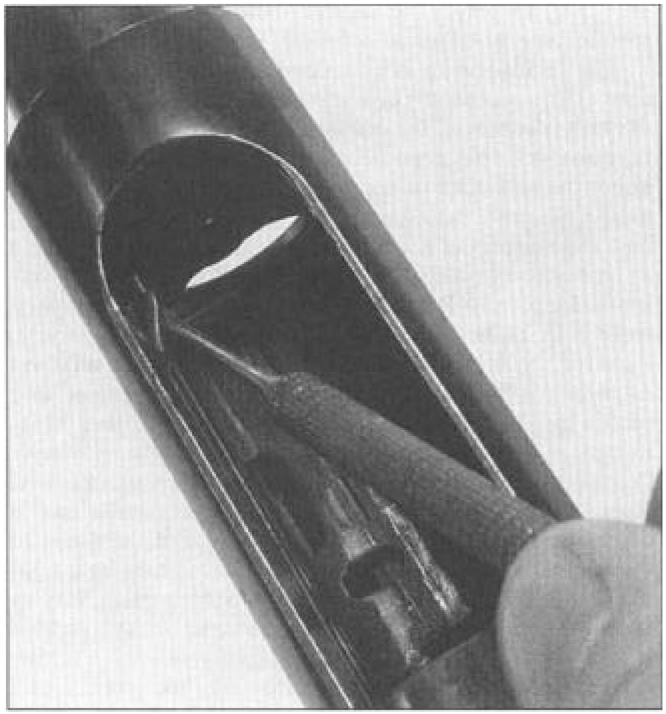
The recoil spring is contained in a tube brazed to the rear of the receiver. The spring does not come out when the bolt is removed for disassembly, and might stay in the tube for years or even decades. At the rear of the stock under the butt plate or recoil pad is the access hole for the action tube nut. After years of use, rain, wet duck boats, and just sweat and humidity, the action tube nut is likely to be rusted in place. Strong men have been humbled trying to remove it. Remove the barrel and gas system parts from your 1100, and clamp the receiver in a padded vise. Remove the buttplate or recoil pad. The action tube nut requires a standard type screwdriver, but you must start with a large screwdriver with a square shank. This situation is just the opposite of your problem finding screwdrivers to fit the screw slots on a Browning. For the Remington, you'll find most screwdrivers will have a blade too thin for the action nut slot. Grind the blade of the screwdriver back until it is thick enough to be a tight fit. If you do not have a large adjustable wrench, buy or borrow one. Firmly clamp your shotgun in the padded vise and stand so you can comfortably hold the screwdriver handle with one hand while using the wrench as a lever with the other. Tighten the adjustable wrench around the shaft of the screwdriver where you can use it

as a lever to turn the screwdriver. Grasp the screwdriver, and lean into it to keep it from twisting out of the slot. Using your grasping hand and the adjustable wrench as a lever, turn the action tube nut loose. Once you have broken it free, you probably can turn the screwdriver with both or even one hand. Pull the action nut and its lock washer out of the recess. Slide the stock off. To remove the recoil spring, use a drift punch to push the rear retainer towards the receiver. Then press the retaining pin out of its cross hole in the tube. Before you ease the spring out, get your free hand over the end of the tube to restrain the spring. It is longer than the tube, and will squirm and shoot free if you don't restrain it.

To clean the spring, wipe it with a cloth, and soak it in Nitro solvent. Swab and brush the recoil spring tube clean as if it were a very small-gauge shotgun bore. Oil the spring before re-installing it. The action fork at the rear of the bolt may shift out of position while you have the spring out. To make sure the fork and spring properly engage, remove the action from the vise. Remove the trigger assembly and hold the fork in line with the tube. Insert the spring into the tube and push it to the receiver. As the front retainer of the spring pokes into view, guide the fork into the recess on the front guide. You will need your needle-nose pliers to slightly compress the tips of the fork into the recess.

Clamp the receiver in your padded vise again. Press the spring into the tube and use a thumb to hold it there. Take your drift punch and press the rear retainer into the tube far enough to clear the retainer pin. Press the pin through and ease the spring into contact. The slot on the rear retainer has to ride over the pin. If it does not, use a screwdriver to rotate it until it does.

Use a good grease on the threads of the action tube nut before tightening it in place. You may not have to take the nut off ever again, but if you do, you want the job to be a little easier. And if you don't ever have to take it off, you'll make the job a little easier for the next guy.



The front of the shell stop. The front should move when pressed, hut not the rear.

Shell Stops

Unlike the 870, with its two long flat shell stops, the 1100 has one flat spring-steel lever set in a recess milled into the right side of the receiver, and a pivoting lever on the left side. (“Right” and “left” as viewed with the shotgun in the firing position.) The flat one is secured at the rear by having the edges of the slot staked down into notches cut in the stops. The pivoting stop has a “C” clip that rides on the stud the stop pivots on. Extensions on the long stop engage the edges of the action bar. As the gas system hurls the action bar back, the beveled edges of the action bar flex the long shell stop in and out. The pivoting stop has a spring to keep it in place, and is activated by the locking lever of the trigger assembly. Properly timed, the shells are launched out of the magazine tube, lifted by the carrier/lifter, and chambered as the bolt goes forward. Improperly timed, the shells don't come out, they all come out at once, or they drop out of the bottom of the receiver as the action cycles.

The long shell stop fails to work for two reasons, one common and one not. The common reason is that it is loose. The uncommon one is that it is

broken. The pivoting stop almost never fails. (If the pivoting one never fails, why not make them both pivot? I don't know.)

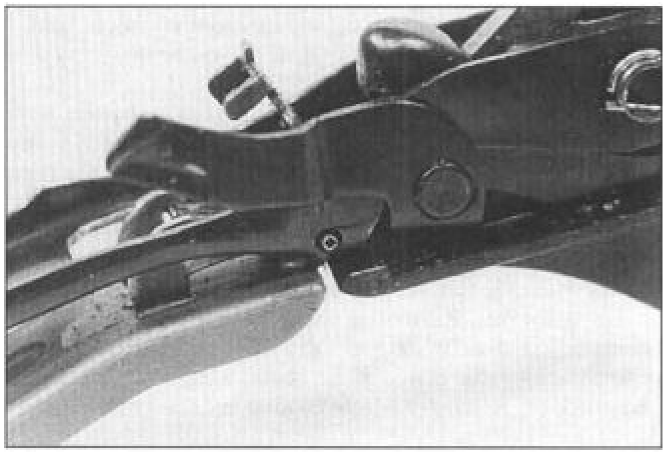
To check your shell stops, make sure the shotgun is not loaded. Remove the trigger assembly. Look at the rear of the receiver. At the edges of the channel in which the long stop rides you will see the staking locations. Press the rear of the shell stop with your fingertips. If it moves at all, it is too loose to work properly. Remove the forearm, barrel and gas system. Take the bolt and action fork out, leaving the stripped receiver on your bench. To re-stake the shell stop you will need a slaking tool from Brownells, a ball peen hammer and some means of holding the stop in place. At a commercial shop it was a few seconds work for me to have someone else hold the receiver in place while I positioned the staking tool and whacked it with the hammer. Working alone, you'll have to use the dual-stake method outlined in the 870 chapter. Lightly peen the edge of the slot, enough to hold the stop in place. Use the staking tool to tap the stop past the preliminary staking.

Place the shell stop staking tool in the existing depression and give it a moderate blow with the hammer. If you hit too lightly, you will not peen the metal over to hold the shell stop ion place. If you strike too hard, the staking tool will bounce after you strike it, and leave small dings inside the receiver.

In 1100s that have been heavily used for a number of years, the shell stops may have been staked into place several times. It may come to pass that the steel in the original staking areas is too peened and worn to properly secure the shell stops any more. Take your hand-held grinding tool and put a grinding stone, sanding drum or cut-off wheel in it. Use the grinder (with glasses and muffs on of course!) to grind new bevels into your shell stop. Stake the stop at the new locations you have just ground.

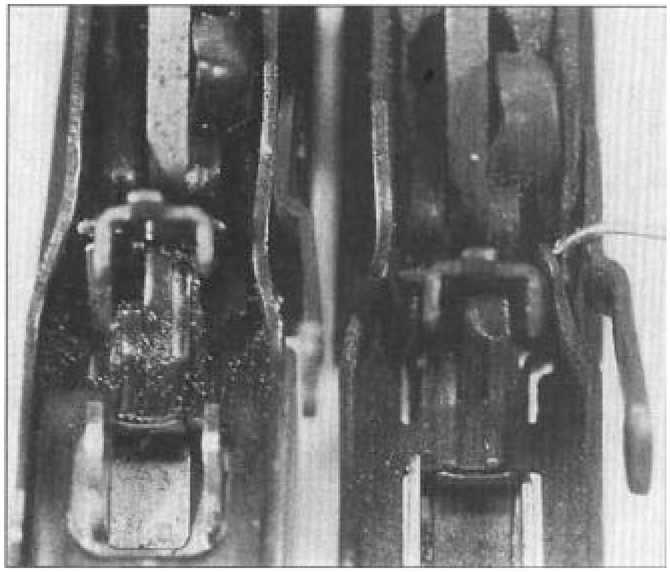
If your shell stop is tight, but not feeding, look at the tip. Broken tips can keep the 1100 from feeding at all, or cause mis-timing in its feeding. In the case of a broken shell stop, pry the old one out. The replacement may not fit in past the existing slaking. Hook the front end of the shell stop into the front recess in the receiver. Place the shell stop into the slot one edge first, so it is tilted. Place the receiver flat on your bench with a cloth under it. Use the staking tool and your ball peen hammer to tap the shell stop into place in the slot. Check its tightness, and if it is slightly loose (it probably will be, after being forced into place) re-stake on what was the high side.

The Lifter



Sticking up in the path of the shell, the catch will unlock the action and chamber another shell only when that shell hits it. If the shell doesn't hit hard enough, or the catch bounces, the action will stay locked open.

The lifter in the 1100 and 11–87 takes a shell presented to it from the magazine by the shell stops and lifts that shell into place for the bolt to chamber it. One peculiarity of the 1100 that you need to know about its operating method: the bolt always locks open. Every time you fire a round, the bolt locks back. When the next shell is fed from the magazine, it is launched into the receiver, and unlocks the bolt when striking a small part at the back of the lifter. If your shell does not strike hard enough, the bolt can't be unlocked, and the new round won't be chambered.



***This is the bolt hold-open latch, in the middle of the trigger assembly. On the right is a 3-inch lifter, with a pointer indicating the secondary latch*.**

Why all this flummery? Simply put, the bolt, if left to its own devices and recoil spring, would cycle back and forth far faster than any magazine spring could send a new shell into the mechanism. Without the automatic lock-back mechanism, the bolt would close on an empty chamber, or the bolt would bind on a shell still feeding out as the bolt was going forward.

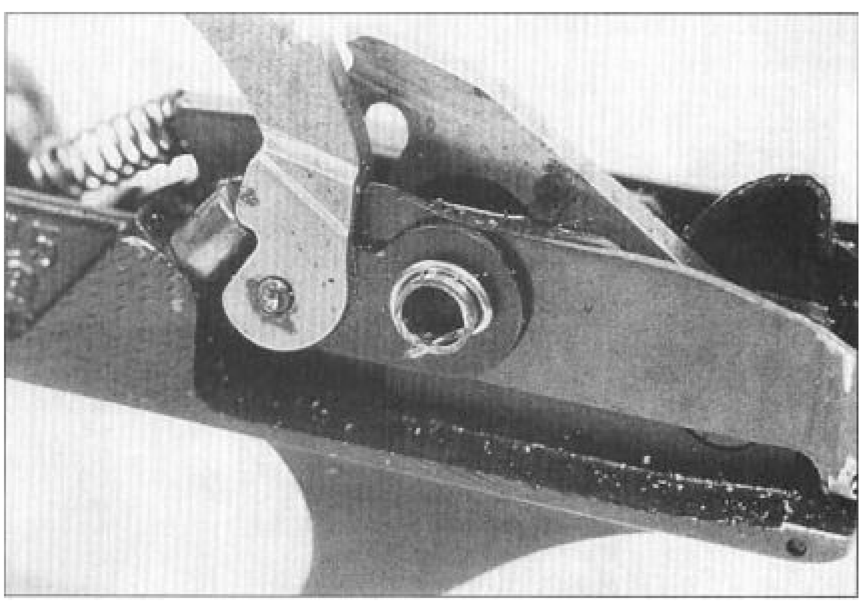
The shell must travel to the back of the lifter without losing energy, or it may not strike the latch hard enough. A weak magazine spring can cause problems. An extended magazine tube can also cause problems. The longer tube (for extra rounds) has a longer spring, but the longer spring has to push greater mass. For competition shooters, it is not uncommon to use a longer than standard spring to ensure that the initial shells are fed briskly enough. However, even 1100s without extended tubes may fail to chamber a round. If you have an 1100 that occasionally leaves a fresh shell sitting on the lifter without chambering it, you have several options. First, replace the lifter with the “3-inch” lifter. Second, remove the binding spots on your current lifter. You can also do both. All 11–87s have the 3-inch lifter as standard. If your 11–87 leaves a shell on the lifter without chambering it, you must time the 3-inch lifter, and remove the binding spots.

The 3-inch lifter was a result of experimentation on two divergent fronts; developing an 1100 that would properly feed and function with 3-inch

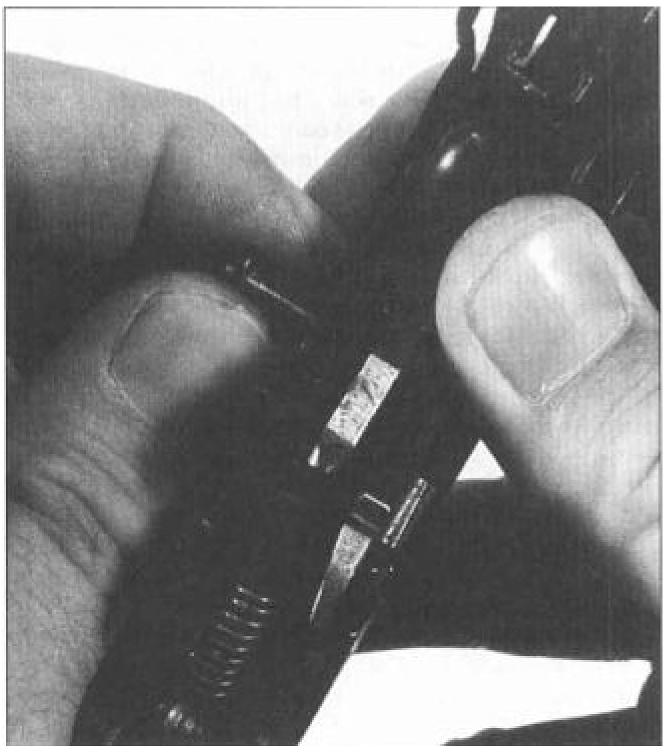
shells, and developing a fully-automatic 1100. In both firing magnum shells and fully-automatic operation, sometimes in feeding the next shell it would strike the lifter latch, but before the lifter could move, the latch would bounce back and re-latch the lifter open. Magnums you can understand, but a 12-gauge machinegun? Remington was working on combat shotguns for the Armed Forces use in Vietnam. In jungle warfare, a shotgun can be very useful. In the opinions of many, anything that is useful can be improved. The “improvement” of fully-automatic shotgun generally meant that it ran out of ammo right away, and overheated in a couple of minutes. But the work done to develop the 3-inch lifter did prove useful, even if the military didn't adopt a select-fire 1100. The 3-inch lifter has an extension on the rear leg that acts as a catch to the lifter latch. As the latch pivots back it bends the leg out of the way. Once fully back, the latch frees the leg to snap back into place, catching the latch back and allowing the lifter to open.

As a competition or defense shotgun, the 3-inch lifter has an added benefit: automatic chambering. On a standard 1100, if you work the operating handle to chamber a round, you have to first draw the bolt back, and then reach underneath it to press the nickel-plated release latch. With the 3-inch lifter, a brisk movement of the operating handle will also unlock the bolt and chamber the round without the extra motion.

The side of the trigger assembly, and the D-ring that both holds the push pins in place, and keeps the tube on the trigger assembly.



I must be absolutely clear on this point: installing a 3-inch lifter in your standard 1100 in no way makes it suitable for shooting 3-inch shells. If you want to shoot 3-inch shells from an 1100, buy one chambered for 3-inch shells, or buy an 11–87. Do not install a 3-inch lifter and 3-inch chambered barrel on your standard 1100. It wasn't designed for it, and will not be happy with it.



With the D-ring lifted off, press the tube to the side and then pull it from the assembly.

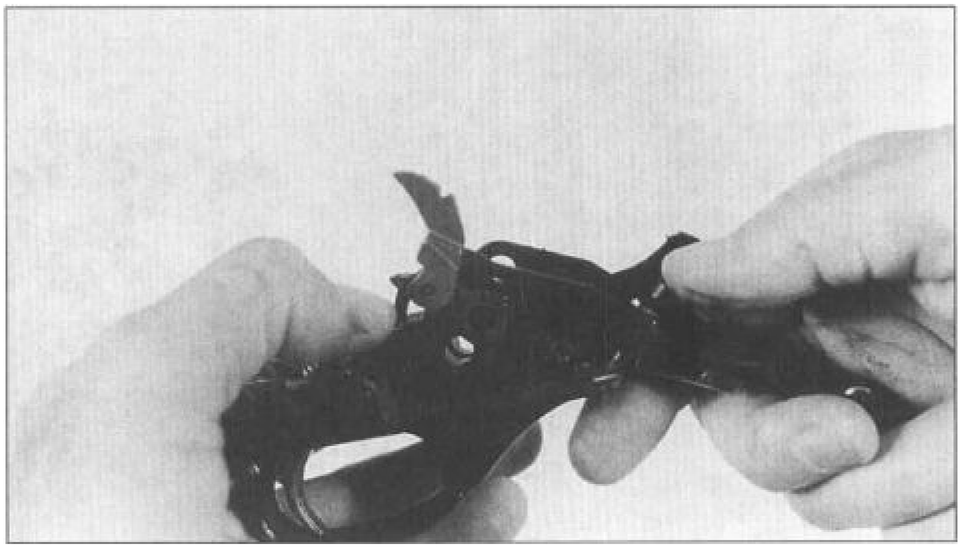
Replacing the lifter is easy. Unload the shotgun. Remove the trigger mechanism. At the rear of the lifter you will see the pivot tube. The tube is also where the assembly pin passes through, and a "D" ring on the tube keeps the pin in place. Lift the D ring out of its seal on the tube. When you press the tube out of the assembly, you will have to maintain control of two springs. One spring and plunger is on the side, and acts to lift the lifter and its payload up into the path of the bolt. The other spring and plunger activate the lifter latch. Use a thumb over each one. First, catch a thumb

over the lifter spring, and slide the tube out. As you ease the lifter off the assembly, use your other thumb to contain the latch spring.

This is the trigger housing without the lifter in place. Careful, sometimes the latch will pivot enough to allow its spring to shoot across the room!

Once the lifter is off, ease the springs out until they are not under tension. Stand the assembly tube on your bench. To install the new lifter, press the latch spring back into its tunnel, and hold the latch in place with one thumb. Slide the lifter in place and use your other thumb to compress the lifter spring. Press the trigger assembly over the assembly tube (standing up on your bench) until it has caught the lifter. You may now release the latch and work the lifter in place as you press the tube over. Replace the D ring.

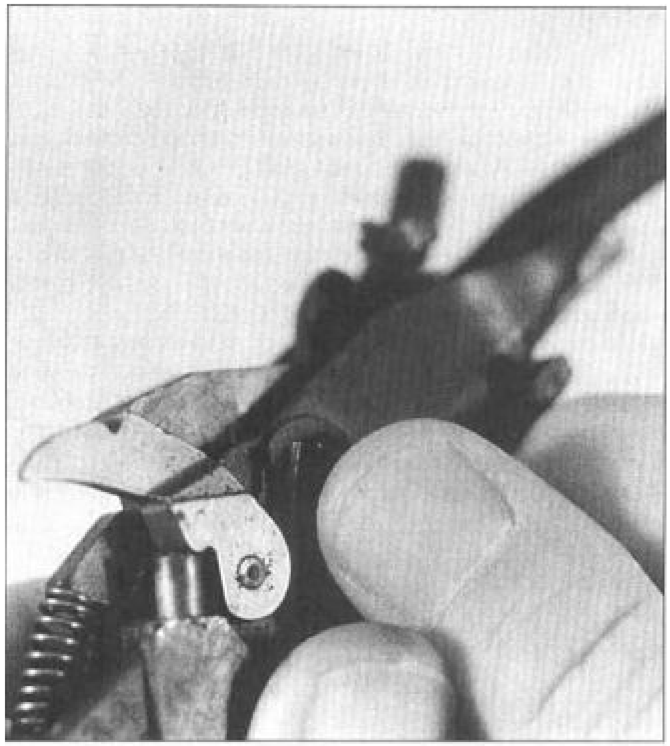
Now you must time the leg of the new lifter. Check the fit. The latch must go back and be caught by the leg. If the leg binds on the latch the lifter cannot be unlocked. If the leg does not catch the latch, you are no better off than with the old lifter. With a pair of needle-nose pliers, bend the leg until it fully catches the latch open, but does not get in the way any more than needed to fully catch. The leg does not need any stoning or polishing, only moderate bending. In the years before the 11–87 came out, I replaced many standard lifters with 3-inch lifters for competition shooters and hunters.



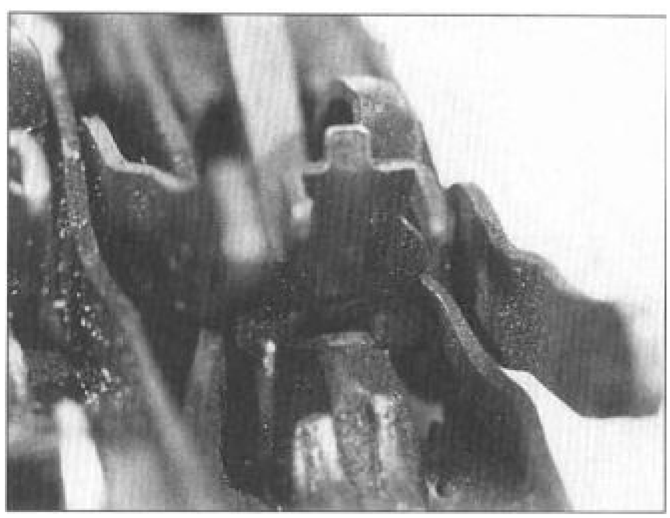
Use both thumbs to control the springs that act on the carrier and latch.

If you don't want to replace the lifter, or want to fine-tune the new one, then you have to remove the rough spots and high edges on the lifter. There are two main places, the leading edge of the lifter and the “fallout tab” on the left side. The leading edge of the lifter is bent in a gentle curl to capture shells coming out of the magazine, and to lift them high enough to enter the chamber. If the curl is slightly different than the radius of the rim, the shell's rim can rub against the lifters leading edge and lose momentum. To check, look for small amounts of brass rubbed off on the leading edges of the lifter. If the leading edges are rough, you can stone them smooth. In extreme cases, the next round out of the magazine will hang up on the leading edge and not feed out of the magazine at all. In the extreme cases, you have to flatten the curl of the leading edge so it does not protrude into the path of the feeding shell. To flatten the liter, removeit from the trigger assembly and clamp the leading edge in a smooth-jaw vise. Squeeze the edge just enough to slightly flatten it, and then test-fire. Repeat as necessary. On the ejection port side of the lifter is a small lab. The tab is designed to keep a shell on the lifter despite the temptation of the open ejection port. Without it, shells could fall out of the receiver while the bolt attempts to chamber them. The lifter is a sheet metal stamping, and the leading edge of the tab can be rough. The rough edge can create enough friction on a shell passing by to keep it from striking the latch hard enough to initiate chambering. Look at the leading edge of the tab for brass rubbings left by the rim as it passes by.

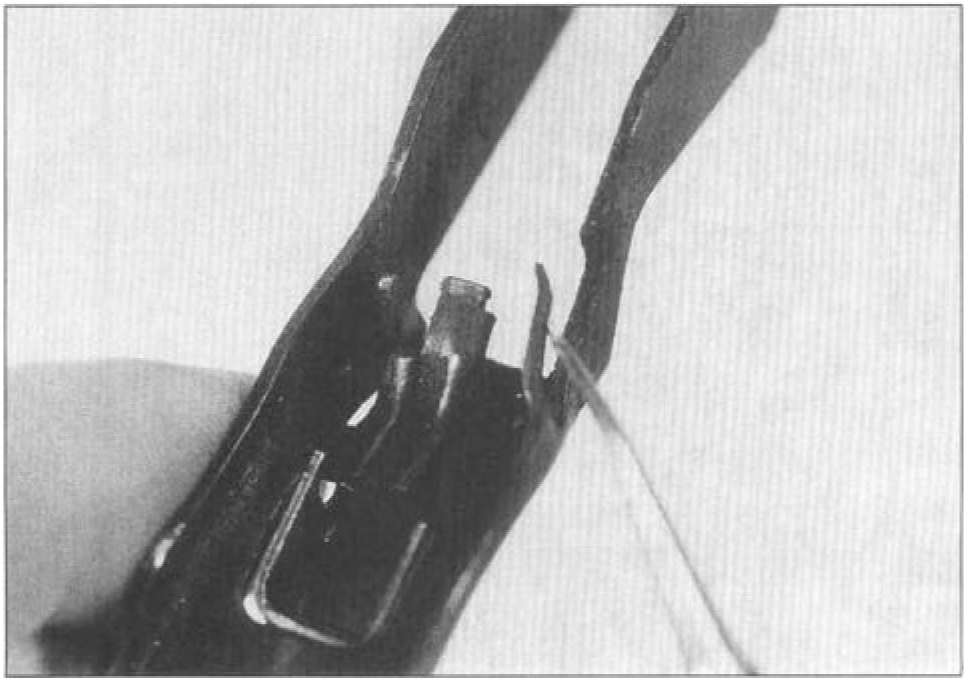
Use a smooth file and then a medium India stone to take the rough edge off of it.



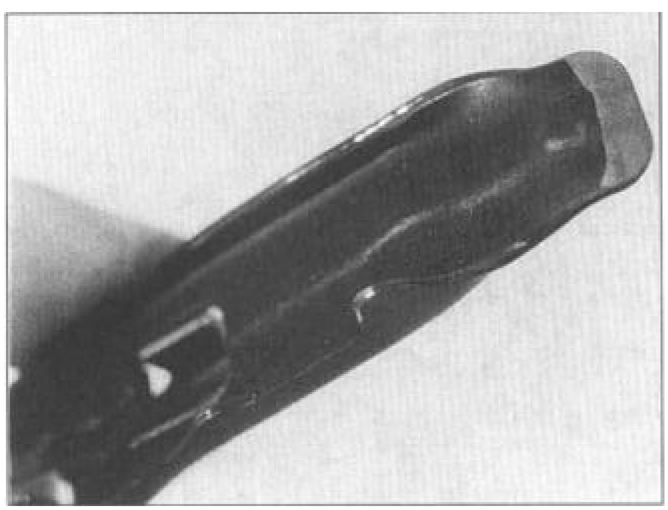
***The D-ring keeps the tube in place. Remove it with a fingertip or sharp point*.**



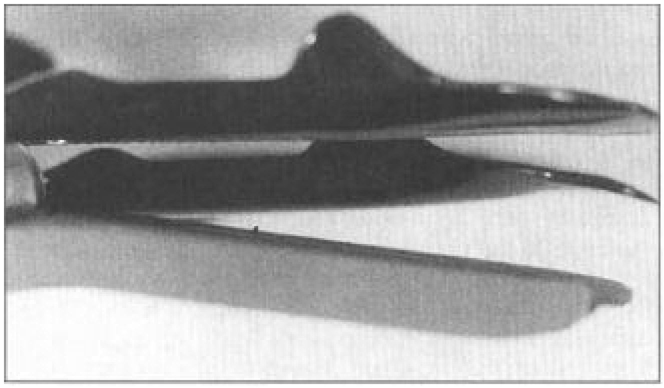
Here the catch leg has been bent just enough to catch the lifter latch, but not otherwise bind it during its movement.



This is the catch leg of the 3-inch lifter. It keeps the lifter latch from bouncing during feeding, and latching the action open.



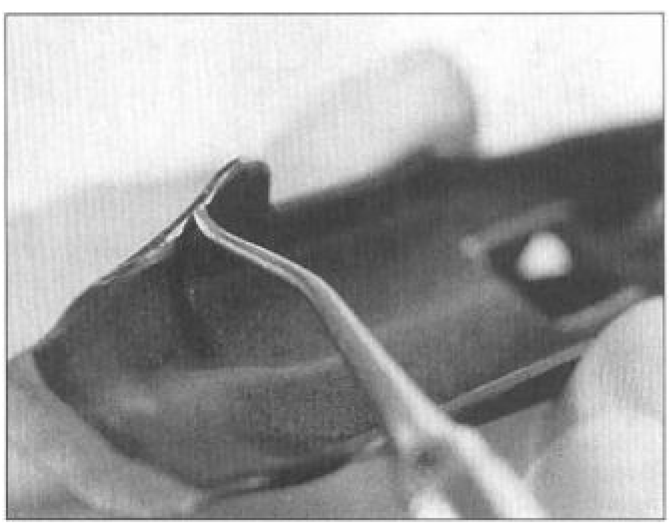
The tip of this lifter has been bent, straightened and polished



The top lifter works as-is, and was left alone. The bottom lifter needed to be straightened and bent. On the bottom is a BMW lifter/feed latch.

Or Lifter

The lifter raises a shell fed from the magazine, and presents it to the chamber. The bolt rams forward and presses the shell into the chamber. The shell must be lifted high enough but not too high. It also must be on the centerline of the chamber. A shell presented too far out of position will catch on the edge of the chamber and cause a misfeed. As if the lifters job wasn't hard enough, it has to collect the shell out of the magazine tube before it can even begin lifting it. The edges of the lifter have to be properly located. If not, misfeeding will result.

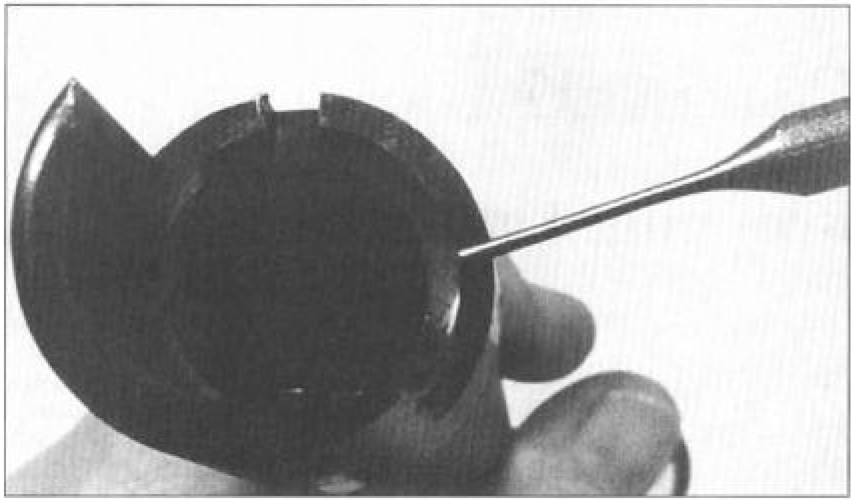


The fall-out tab keeps shells from falling out of the mechanism while feeding. If the leading edge of the tab is sharp, or in the path of the shell, it can slow the shell's feeding and

Clamp the lifter tip in a vise and flatten it. If needed, use pliers to bend the tip slightly, reducing lifter rub against the barrel extension.

In order from bottom to top, the misfeeds are: stubbing out of the magazine tube, short lift to the chamber and high lift against the barrel extension. The first and last problems stem from the same problem, the front edge of the lifter is too high. The stubbing may be a subtle problem, and present itself to you as shells that sit on the open lifter, but with the bolt still locked back. The shells are catching on the edge of the lifter, and some have enough energy taken out of them by the edge of the lifter that they do not strike the latch with enough force to unlock the lifter. Some 1100s with stubbing are not the least bit subtle. An obvious case of stubbing leaves the action locked open, and the shell partially out of the magazine tube, caught on the leading edge of the lifter. Two partial solutions to stubbing are to either bevel and polish the leading edge of the lifter, or file the rear stop surface of the lifter. Beveling the leading edge eases the passage of each

shell. Filing the rear stop surface (the one resting against the trigger assembly housing) lowers the leading edge of the lifter by letting it pivot down a bit farther.



As in the 870, the feed ramp and bottom of the chamber can be rough or have sharp edges. Polish and remove sharp edges.

Neither of these solutions helps if your 1100 is also bringing the shell up too high. High lifting creates friction during chambering. The shell, pressed against the barrel extension, rubs hard and can be slowed in its forward progress.

The solution to both stubbing and high lift is to alter the shape and location of the leading edge of the lifter. By lowering the angle of the lifter you solve stubbing and high lift. Beveling the leading edge and filing the rear stop only treat stubbing, and if your 1100 is stubbing, it is probably experiencing high lift, too. Take the trigger assembly out of the shotgun. Remove the lifter from the trigger assembly. Look at the lip of the lifter. You will see that the front of the lifter is curled. In biology class we learned that being able to curl your tongue or not is a genetic trait. Either you have it or you don't. All 1100's have it. In the case of an 1100 that is stubbing or suffering from high lift, the curl gets in the way. Clamp the leading edge of your lifter in your vise. You want to have about a ¼ inch in the vise jaws. Close the vise jaws until you have squeezed the curl of the leading edge flat.

Take the barrel and your hand-held grinder with a polishing bob in it and polish the rub marks along the top of the barrel extension, and polish the feed ramp. Clean the grit off after polishing.

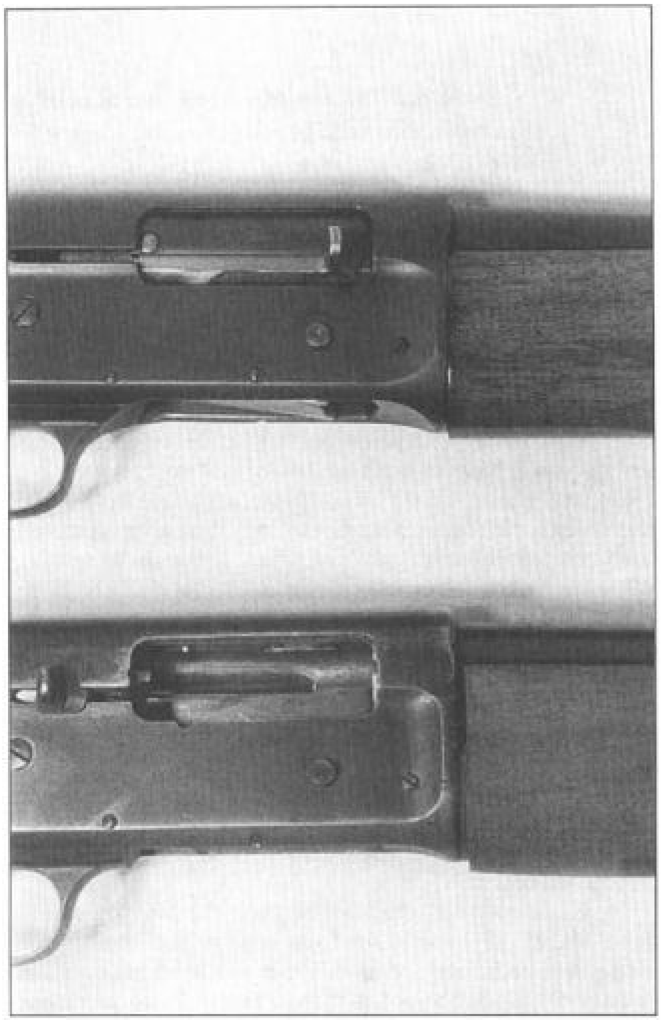
Reinstall the lifter in your trigger assembly, and reassemble the shotgun. Test fire it to make sure it is working properly. In extreme cases simply flattening the lip of the lifter is not enough. If your 1100 still stubs even after flattening, you'll have to bend the lifter tip. Take the lifter out again, and clamp the tip in your vise at the same spot you had when you flattened it. Grasp the lifter with your left hand and pull it back, away from the side the shells rest on. With the lifter tensioned, tap the inside face of the lifter with a ball peen hammer, striking just above the vise jaws. You want to bend the lifter right at the edge of the vise jaws, not part of the way up. If you simply grab the lifter and wrestle it back, you'll bend the lifter an inch above the vise jaws, and the lifter will not bring the shells up nearly high enough.

If tapping to bend the lifter does not appeal to you, you can use a large pair of pliers. With the pliers reach from the side and grasp the lifter as close to the vise jaws as possible. Gently bend back.

By either method, you want to bend the lifter only until there is a visible bend in the front edge of the lifter. If you used pliers and there are marks, use you hand-held grinder and a polishing hob to polish the marks out. Reassemble and test fire. You will find that stubbing is a thing of the past.

Short lift hardly ever happens and is rarely the lifter's fault. Usually the lifter spring is broken, crushed or binding. Disassemble the trigger mechanism and clean the spring, its hole and cap. Replace the old spring with a new one.

Chapter 17
The Browning Auto-5



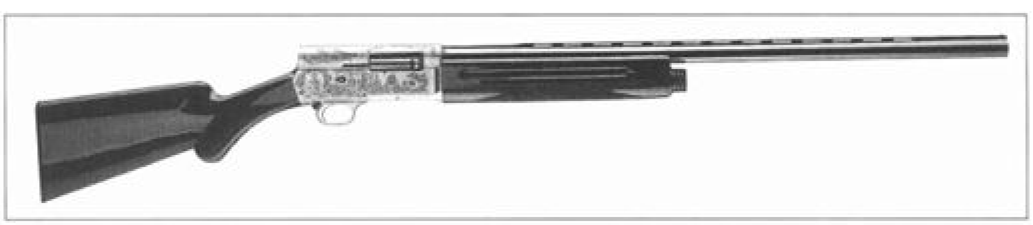
Winchester wanted lever-actions, and Browning had designed a revolutionary shotgun. It was the last gun Browning designed for Winchester, and the only one they didn't buy.

At the end of the 19th century, John Browning had a good racket going. (As a faithful Mormon, he would no-doubt have been pained to hear it described that way.) He supplied Winchester with the designs they wanted, successful and reliable designs that they turned into desirable and valuable firearms. In addition to the designs that Winchester wanted, Browning

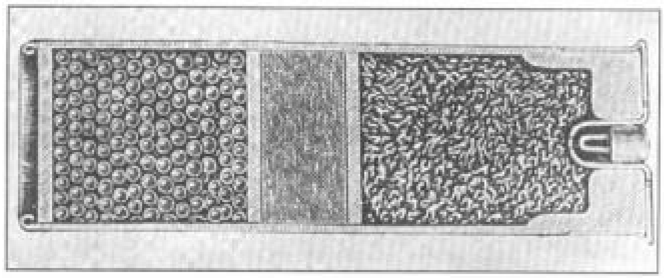
produced similar designs that fell into the same market segment, designs that had different features he or someone else could patent. In order to keep the designs from his competitors, the president of Winchester would buy all the designs, even the ones he didn't want, and patent them. The patents were written up by the Winchester engineers and lawyers in Browning's name, and Browning would then assign them to Winchester. Winchester had the market sewed up, and Browning made buckets of money.

The fly in the ointment was that T.G. Bennett, the President of Winchester, wanted lever-actions. He had even made Browning design lever-action shotguns. Despite the runaway success of the pump-action Model 1897 (it probably sold more in its first two years than both lever shotguns did in their entire production life) Bennett was leery of non-levers. And in 1898 Browning had more than a non-lever gun, he had a revolution.

The Browning Automatic Shotgun neatly sidestepped a big problem of the time. Not only were shotgun shells loaded to highly different power levels, many shooters still insisted on using black powder. Factories and handloaders still turned out large numbers of black powder shotshells in 1900. Smokeless was new and dangerous for the personal reloader, black powder simple and safe. Even as a factory-loaded proposition, smokeless had problems. The early powders were porous, irregular in grain size and shape, and a low-density product. The low density made the engineering task of fitting the new smokeless into the huge hulls required for black powder easier. But the porosity made smokeless susceptible to humidity. The powder in a stored shell could fluctuate several percentage points in its moisture content, changing its burn rate and power. Humid powder would have less power.



Even though production has ceased (for now) on the A-5, Browning made the last one a good one.



The main obstacle to coming up with a reliable self-loading shotgun was black powder and its bulky and hygroscopic residue of firing.

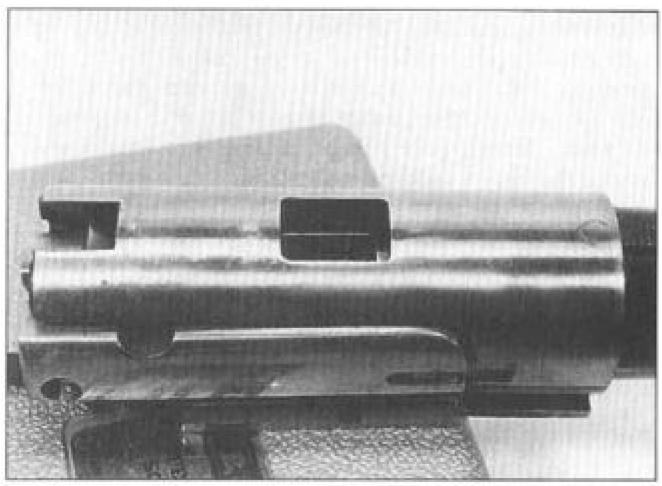
Black powder shells could be loaded with anything from 3 drams to 4-½ drams of powder. The smokeless shells could be loaded to the same velocity equivalent with much lighter charges of the more-powerful powder. Any shotgun that used the combustion gases to work the action would soon quit from the heavy black powder fouling. Even if restricted to smokeless only (and some shooter would forget, rust his gas system and raise holy hell with the manufacturer for making a "defective" shotgun.…) the power difference between the 3 and the 4-½-dram equivalent was too much to allow any gas system to accommodate. Even if restricted to smokeless only. And even with a single load, variations in the humidity would change power and gas function. No, a gas-operated shotgun was a long way off in 1898.

Instead, Browning used recoil. The Browning long-recoil mechanism is simple in explanation and a mechanical marvel. Upon firing, the bolt and barrel stay locked together, and travel backwards into the receiver. At the end of their travel, the bolt locks in place. The barrel thrusts forward, powered by its own recoil spring. The empty shell stays clamped to the bolt by the extractor until the ejector, on the rear end of the barrel extension, hurls it out into space. During all this, the next cartridge in the magazine has been riding along underneath. The bolt has a shell stop on its bottom, and that shell follows the bolt back under recoil. When the shell follows the bolt, its rim cams the lifter lock out of position, releasing the lifter, raising the shell and unlocking the bolt. Without a shell, the bolt stays locked back. The barrel slams to a halt at the front of the receiver as the bolt is released. The forward-moving bolt gobbles up the new shell, chambers it, closes and locks to the barrel.

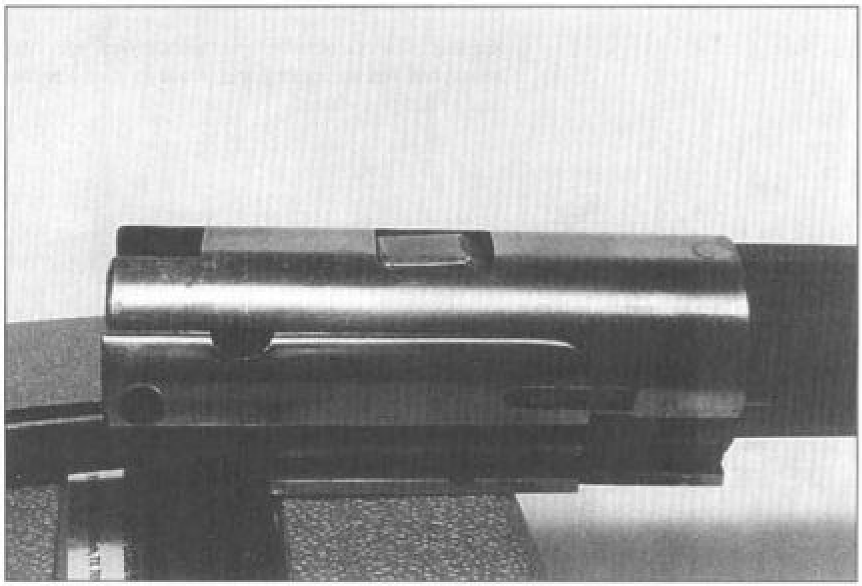
The camming of the left-hand shell stop by the barrel (you can see it on the left outside of the receiver) prevents a second (actually third, if you

count the fired shell as the first) shell from coming out of the magazine. The action is a marvel of levers and timing.

No gases are released into the receiver. The brilliant part of the mechanism is in the braking. The barrel hanger encircles the magazine tube for guidance, and bears on the recoil spring. Between the barrel hanger and the recoil spring is one or more friction ring. The bronze of the friction ring rubs against the magazine tube and keeps the barrel's recoil under control. Indeed, if the magazine tube is too rough, or the ring is not kept lubricated, it can create enough friction to keep the action from cycling.

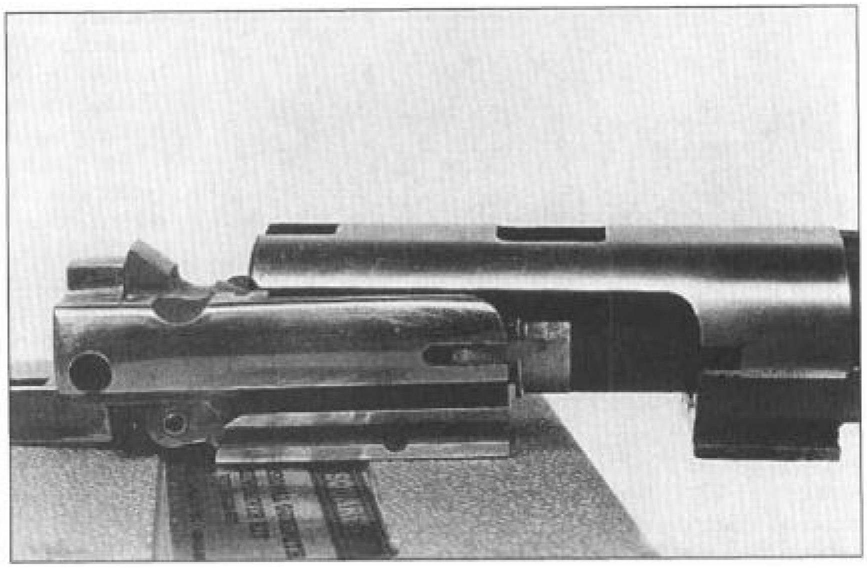


Once the bolt and barrel have traveled to the rear of the receiver locked together, the bolt unlocks from the barrel.



The bolt locks to the barrel extension, and not the receiver.

The Browning A-5 was radical in looks and in function. T.G. Bennett wasn't sure he wanted it. Then Browning told him that while the old deal was good enough for the previous products, on this one he wanted royalties. Bennett dug in his heels. For two years, Bennett hemmed and hawed, refusing to commit to purchasing the shotgun. For two years the engineers and lawyers worked on patents, and Browning even came up with some additional improvements. Finally, Browning told Bennett, either agree to royalties or give the gun back. Bennett gave it back. I have occasionally wondered if the two-year delay on Browning's part wasn't deliberate. You see, when he left he took the shotgun patents with him. The Winchester engineers and lawyers did such a good job that it was impossible for later competitors (including Winchester) to make competitive models. As one example, Browning invented the operating handle, and Winchester wrote the patent for it. Not only did he invent the operating handle, he came up with two other ways to do the job!



***And the barrel rushes forward, propelled by its own recoil spring*.**

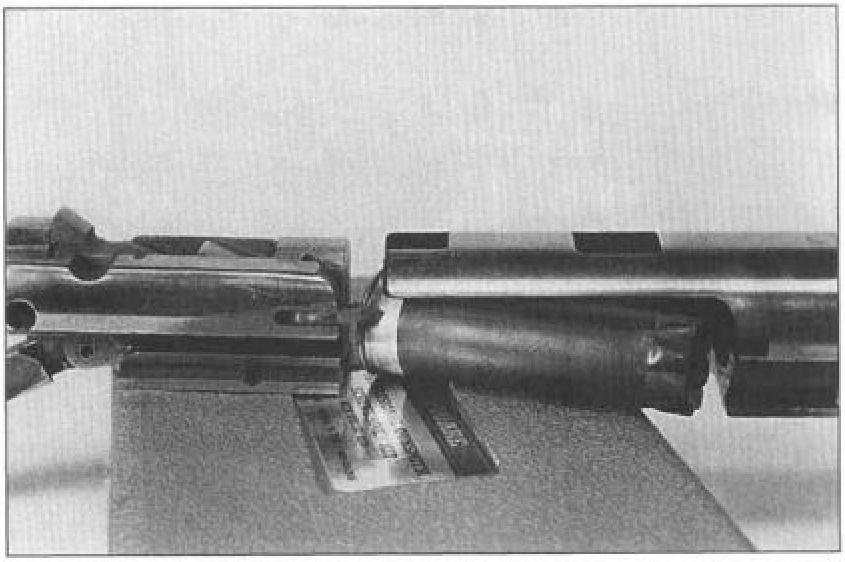
When Winchester belatedly brought their own auto shotgun onto the market, the Model 1911, they couldn't use the operating handle without paying royalties to Browning. Instead, to cock the Winchester 1911 you had to grab the knurled section of barrel and ram the barrel back into the receiver.

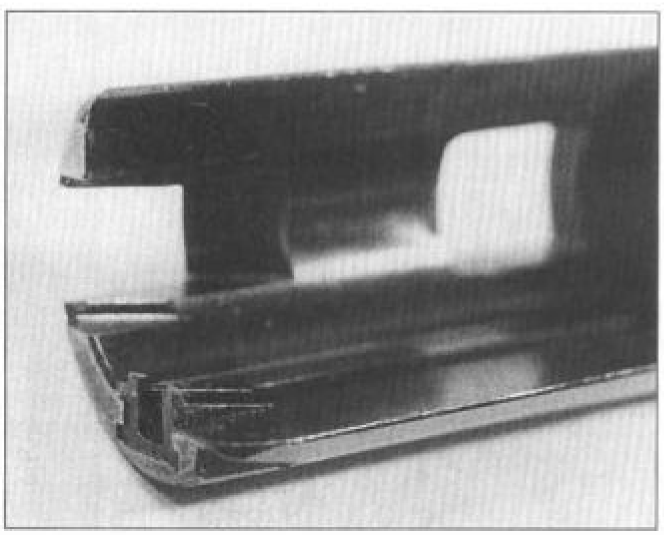
Browning took the model and patents to Remington. While Browning was waiting, the President of Remington had a heart attack and died. The only manufacturer left was overseas. Browning packed his bags and the shotgun and went to Belgium. Browning had been working with Fabrique National since 1897. He had put the factory back on its feet with his pocket pistol known as the Model of 1900. And, he had been paid royalties for its manufacture, not a flat fee. The work and contract with F.N. had no-doubt sparked Brownings desire to get royalties from Winchester. Once at the F.N. plant, Browning was greeted with open arms. The resulting agreement was that the Browning shotgun would be made by F.N. in their modern plant in Liege, Belgium. Upon sealing the deal, Browning placed the first order for his own shotgun, with 10,000 of them to be shipped to New York as soon as they were made. Those 10,000 shotguns sold out in the first year.

The first guns left Liege in 1903. In 1904 America slapped high tariffs on imported manufactured goods. Browning negotiated with FN, to assign U.S.

manufacturing rights to the Auto-5 to Remington. Starting in 1905, the Remington Model 11 began a 40-year run of production.

As the barrel rushes forward, the ejector mounted on its rear face, knocks the empty out of the receiver.

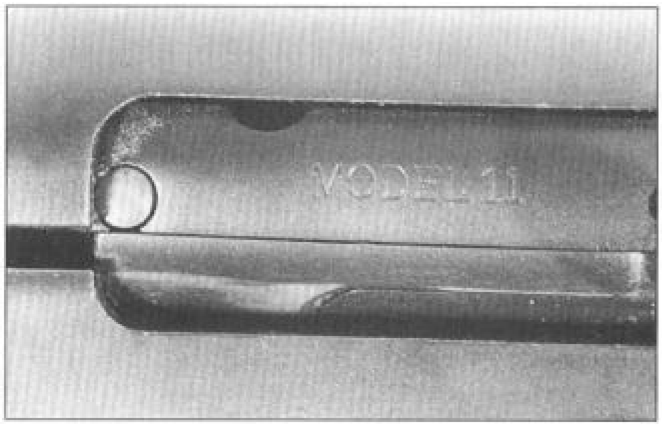




Here is the Browning ejector. The Remington 11 and the Savage 720 ejectors are each a single hook, and thus barrels are not interchangeable.

Later, Browning and his heirs assigned the manufacturing rights to Savage. Once the patents ran out, others made copies of the Auto-5. Some, like the Remington and Savage, are such close copies that some parts will interchange with the Belgian A-5's. Others use the long-recoil principle but their parts will not fit the Browning.

F.N. alone has made over a million of them. Alas, they are made no more. The cost of manufacturing proved too high, and the world's most reliable autoloading shotgun is available only as a used gun.

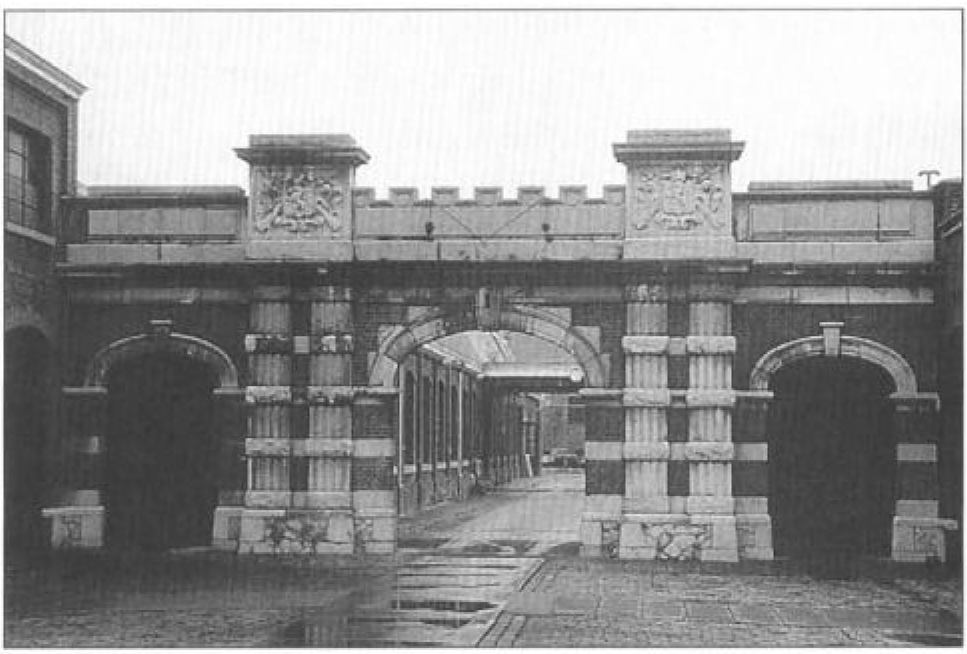


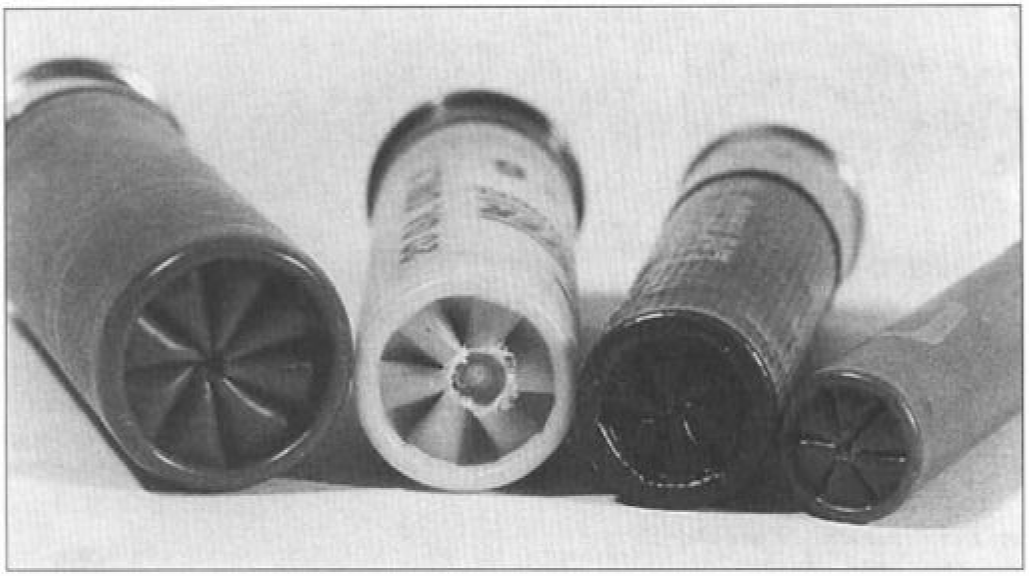
The Remington Model 11 is a close copy of the Browning, but only some of the parts will interchange between the two guns.

How reliable is “most reliable?” As with his loaner 870s, Richard Davis of Second Chance has loaner autos. He loans Browning A-5s. They have never failed. When I decided to get serious about bowling pin shooting with a shotgun, I built up a Remington M-11 that had been manufactured during World War II for the armed forces. With a 20-inch barrel and an eight-shot tube, I practiced relentlessly with it. In 10 years of bowling pin and falling steel plate shooting with it, it failed once, and the failure was not its fault. I was using shells I had loaded using buckshot in low-brass Winchester AA hulls. During a run on bowling pins, the Remington had extracted the brass head off of the shell, leaving the plastic hull in the chamber. It almost chambered the next hull, even with the plastic from the previous hull still there. In 10 years of thousands of rounds of practice and competition per year, that is the only time my Remington M-11 ever stumbled. In many years of working on A-5s, I found that neglect was the biggest cause that

kept them from working. Upon opening many receivers, I found the most surprising stuff. The usual dirt, powder residue and stiffened oil. But also leaves, pine needles, bark, and even a primer. It was beaten into a cube from being in the receiver during repeated firing, but it was a recognizable fired primer (no doubt blown out during firing) and the owner had not brought it in complaining of malfunctions. He had brought it in for a routine cleaning, and was going to go out in a week or two for more hunting. None of the parts were bent or broken, and it had not failed to fire for him, despite the primer floating around inside. Now that is reliable.

When he went to sell his revolutionary shotgun to Fabrique National, John Moses Browning had been through these gates before. Through a century and two wars, FN have kept them up for him.





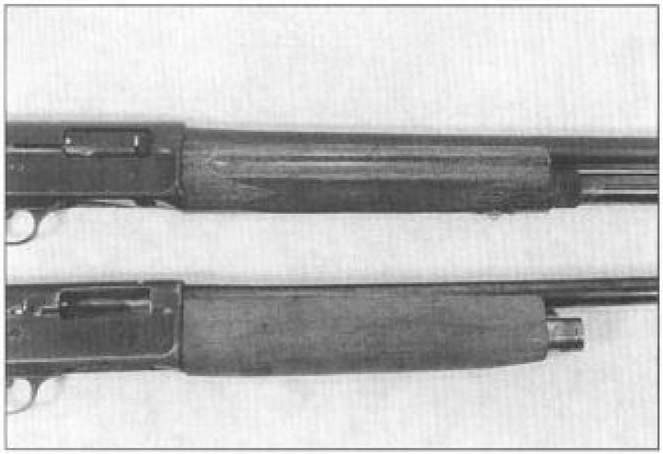
***The Browning long-recoil action has been made in five shotgun gauges there are 12, 20, 28 & .410) and in the Remington Model 8 rifles it was produced in five rifle calibers*.**

The Browning and its clones have been made in 12-, 16-and 20-gauge. Other copies have been made in those gauges and 28 and .410. They're everywhere.

Browning, Remington, Savage

They look the same, but are slightly different. The Browning, originally and continually made in Belgium (except for the occasional war) for more than 90 years, is metric. The Remington and Savage are dimensioned by the inch, and, as a result, screws will not fit from the Browning to its American cousins.

What will fit is the Browning two-piece lifter. And, as an expensive but available replacement, the Browning forearm will fit Remington and Savage shotguns. Trying to find a replacement forearm for a Remington or Savage can be difficult. When I was building my Remington M-11 for competition, I had to find a new forearm for it. I was having no luck locating a Remington forearm, and one day out of frustration I tried a Browning forearm from a customer's A-5. It fit perfectly. I checked the price of a new Browning replacement forearm, swallowed hard, and ordered it.

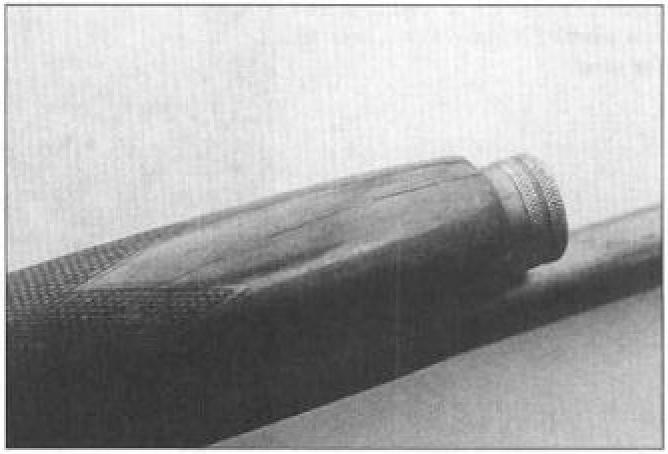


The Remington 11 forearms are bulkier than the Browning. Luckily, Brownings fit, and can be used as expensive replacements.

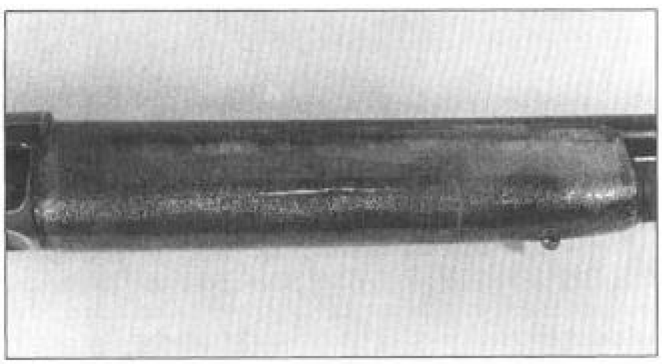
While the stocks appear similar, there is just enough difference in the dimensions that re-fitting one stock to fit another is a major hassle. If you need a new stock for your A-5 or clone, order the correct one. If possible, send the action in for fitting and let the stockmaker do the hard part.

The friction rings are interchangeable. I have seen quite a few Remingtons with Browning friction rings in them. My guess is that the rings became lost during cleaning, and since the Browning A-5 was still in production after the war and the Remington M-11 wasn't, the owners ordered the parts they could get rather than wait for the parts they couldn't.

But the big question is barrels. Browning barrels will not work in Remington or Savage, and vice versa. The big stumbling block is the ejector. On the Remington and Savage the ejector is a single hook brazed to the rear of the barrel extension. On the Browning the ejector is a pair of hooks. The bolts of each are slotted to fit their proper ejector. The wrong barrel won't clear the bolt and the ejector will get hammered if you try. Barrels of the Remington and Savage shotguns have a limited potential to be interchangeable, due to the shell stop cam cuts. The cam cuts are beveled notches on the exterior of the barrel extension. They work the cartridge stop that prevents a second shell from feeding out of the magazine.



Unless treated and assembled properly the Browning forearm will crack.



To deal with the cracking caused by slugs, this Remington Model 11 forearm has been treated like a boat hull. Epoxy and fiberglass cloth cover and reinforce it.

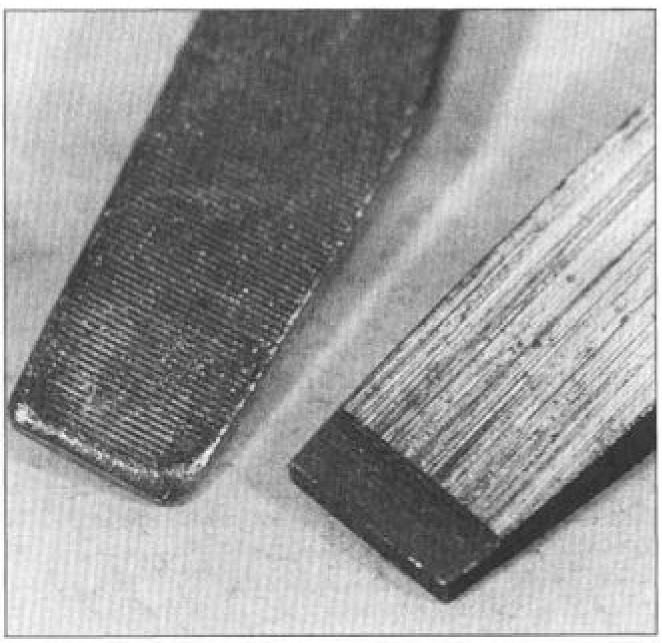
Slight variations of dimensions through the decades allows some barrels to work in both models. Like I said, “some.” Most do not. The only way to be sure is to try it. First, try feeding dummy rounds, and if that works then test-fire. The best idea is to buy the correct barrel for your gun.

The Browning, in particular, has narrow screw slots. The Remington and Savage will have screw slots closer to normal, but still on the skinny side. The Browning will have nearly knife-edge slots. You will have to grind or file your screwdriver blades so they are narrow enough to fit the slots.

Start by making sure the gun isn't loaded. Lock the bolt back. Place the buttplate against your bench with the barrel vertical. Grasp the barrel with

one hand and press it back into the receiver and inch or two. With your other hand, unscrew the magazine cap. With the cap off, ease the barrel forward. The barrel will push the forearm forward, so lift the forearm off the magazine tube. Pull the barrel out of the receiver and set it down. Hold the operating handle and press the bolt release button. If you do not hold the operating handle when you release the bolt, the bolt will slam forward until it is stopped by the operating handle striking the forward edge of the ejection port. (Yes, that is the cause of the ding you find there in many A-5s.) Ease the bolt forward until it rests against the front edge of the ejection port opening.

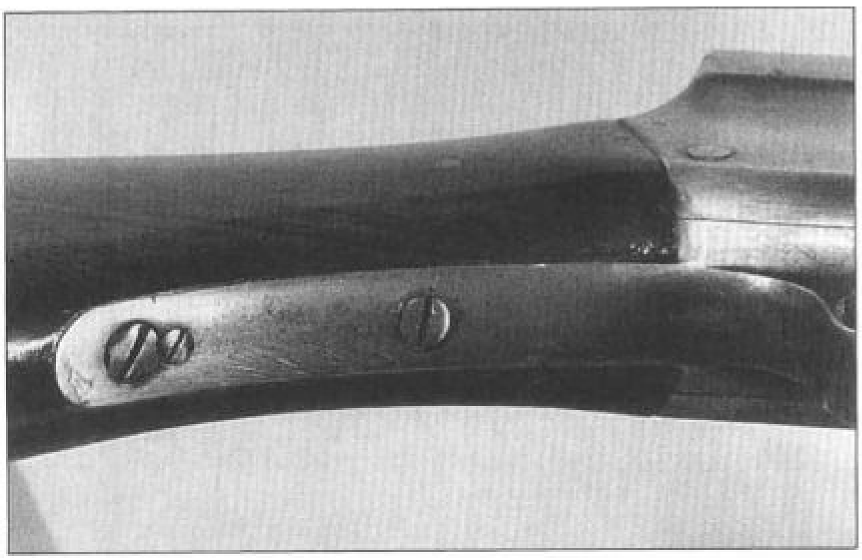
Look at the friction rings. The rings can be stacked in several different sequences depending on what loads you are shooting, and what kind of recoil-reduction apparatus you might have. Slide the springs off the magazine tube. The easy part of disassembly is over.



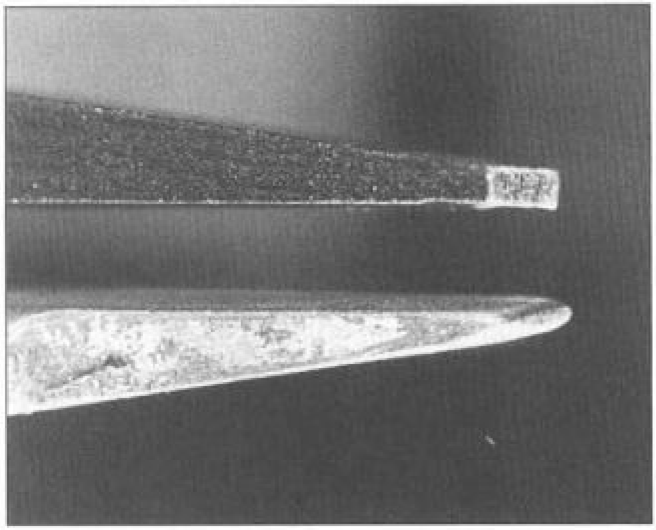
Brownings use extra-narrow screw slots. You'll have to grind a screwdriver to fit.

On the bottom of the wrist are two or three screws. The Brownings and many of its clones use small locking screw to keep the larger screws in place. On the underside of the wrist are two main screws. One is the tang screw that holds the buttstock on, and the other is the hammer spring screw.

On locking-screw guns, the tang screw is the one with a locking screw and the hammer spring screw is the one without. On all of them, the tang screw is the rear one. Loosen and remove the locking screw and then the tang screw. Put a folded-up towel on the edge of your bench. Hold the receiver with one hand and the buttstock with your other. (The hand holding the receiver should also restrain the operating handle. Otherwise, on striking the pads the bolt will bounce, and ding the ejection port.) Bring the receiver down vertically, striking the square hump on its rear on the padded edge of your bench. The stock should slide free. If it only moves a bit, repeat until it comes free.



Underneath the wrist are the tang and hammer spring screws. The one with its own locking screw is the tang screw. Start here for dissassembly.



***Once you've ground your Browning screwdriver, store it away from the others, and mark it. The flats on this one are nicely parallel and the tip is square*.**

On the left side just above the trigger guard are two screws. As with the tang screw, they will have locking screws. Loosen and remove the locking screws and then the two trigger housing assembly screws. (On the Remington the forward one is not a threaded screw but a screw-headed smooth shaft. Once the locking screw is out you can push the shaft out.) Pull the trigger assembly down and out of the receiver. On some guns the lifter spring will be attached to the trigger housing. On most it is in the receiver. Look inside and you will see the flat spring wrapped around its pivot post. The open ends will be caught between the compression post and the rear lip of the lifter. Push the compression post end of the spring down and press it to the side until it comes free. Pull the spring to the side and off of its pivot post.

The lifter pivots on two screws. They are the large-headed ones above the trigger assembly screws. Remove their locking screws and then unscrew the lifter pivot screws. On the Browning they are fitted to a particular side, so place them on your bench so you'll remember which side they came from. With the pivot screws out, the lifter will fall out onto the bench.

Extending from the rear of the bolt is the action bar. It connects the bolt to the action spring. You have to remove the action spring to disassemble the action. I prefer to remove it from the front. Place your receiver upside down in a padded vise and gently clamp at the rear. The hollow receiver can be

bent if you over-tighten, but the rear face supports the receiver against squeezing. With a rod or screwdriver, press the action spring cap back into the tube, and lift the action bar out of line with the cap. Unlike the Remington 1100, the A-5 action spring cap is not held in place by the receiver. When you release the cap it will shoot out of the tube and into the receiver. Grab the cap and pull the spring free. The spring is much longer than the tube, and if you remove the rear cap first you are likely to shoot the greasy and dirty spring across the room. The end cap is held in place by a small crosspin. With the spring pressure gone it is easy to push the crosspin free and pull the end cap out of the tube.

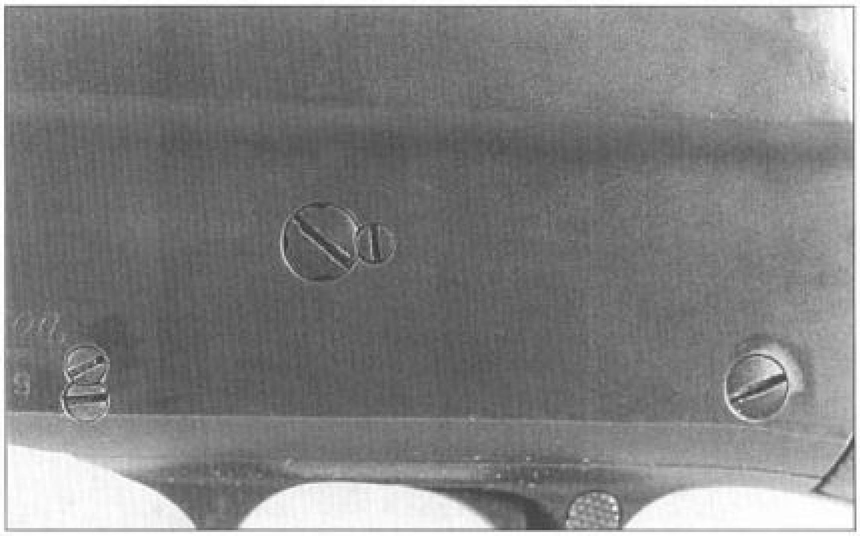
Take the receiver out of your vise. On the bottom edge of the ejection port you will see a semicircular notch. On the bolt there is a pin. The pin holds the bolt-mounted shell stop to the bolt, and this shell stop is currently keeping the bolt in the receiver. On some clones you have to pivot the action bar down and press the operating handle back and off the bolt to uncover the pin. Line up the pin with the notch and turn the receiver over. There is a small hole in line with the pin and notch. Stick a drift punch through this hole and press the pin out.

Turn the receiver on its top. When you pull the drift punch free the shell stop will come free. Pull it and its spring out of the bolt. If you have not done so already, pivot the action bar down and press the operating handle out of the bolt to the rear. The bolt is now free to exit the receiver to the front.

You can now scrub and lubricate everything.

There are not many tricks to the A-5, but there are a few things that make wrestling it back together easier. Once you have the bolt and operating handle back in the receiver, line up the pin hole and notch. Place the pin through the notch and into the bolt, but not through. The pin will keep the bolt in place while you get the shell stop and its spring in place. The hole through the shell slop is oval, and you will have to compress the spring to get the shell stop in line with the pin. Once lined up you can press the pin mostly through with your finger or thumb. Use a drift punch by hand to press the pin until it clears the ejection port rail.

The Remington 11 differs slightly from the Browning. Top-center is the carrier screw. On the right is the rear trigger housing screw (on the Remington it lacks a locking screws). On the left is the front trigger housing, non-screw. On the Remington, only the locking screw is threaded, and the front pin is simply a captured pin.



Pivot the action bar up and run the operating handle into its slot in the bolt.

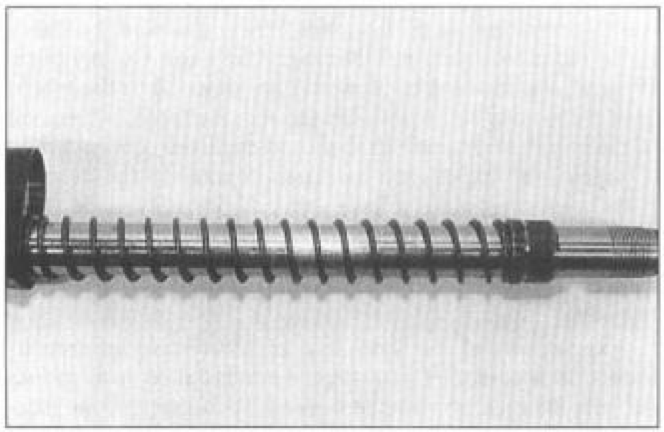
To install the action spring, clamp the receiver in your padded vise. Slide the front cap of the action spring into the tube and press the spring forward until it pokes out into the receiver. Press the action bar in line with the action spring cap and slide the spring in until it has captured the bar. Now, compress the spring into the tube. With one hand wrapped around the tube, use that thumb to keep the cap in the tube. With your other hand pick up the cross pin and insert it into the cap through the retaining holes in the tube.

Place the lifter in the receiver and install the lifter pivot screws and their locking screws. If your A-5 has a lifter spring attached to the receiver, slip the spring over its pivot pin. Press the spring down, flex it to the side just enough, and slide the tip under the end of the lifter. If your lifter spring is attached to the trigger assembly, slide the spring over its pivot post on the assembly.

In both designs, the lifter spring bears against the trigger assembly, and when you insert the assembly the spring will push it out of line. To keep the assembly under control, start by placing your receiver on its right side with the operating handle over the edge of your bench. Grasp the receiver near its rear end. Press the trigger assembly into the receiver with your right hand while you keep the receiver held down with your left. Once the trigger assembly is lined up, hook your left thumb through the trigger guard and hold the trigger assembly in place. Pick up the trigger assembly screws and

press them through the left side of the receiver and the trigger assembly. Once the screws are in place, the trigger assembly won't shift on you.

The buttstock is tightly fitted to the upper and lower tangs. Once you have the receiver assembled, slide the stock over the action tube. It will probably stop before it slides fully into place. To seat the stock, hold the receiver with one hand while you slap the buttplate with the palm of your other hand. Once it bottoms out, rap the buttplate against your bench to tightly seat it. Press the tang screw through and tighten it.



The heart of the Browning long-recoil action are the friction rings and the recoil spring encircling the magazine tube.

The recoil spring and friction rings go on before the barrel and forearm. Set the spring and rings according to what load you will be using. Make sure they are properly lubricated. Lock the bolt back. Slide the barrel onto the magazine tube and into the receiver. Hold your A-5 vertically with the buttplate against the bench. Press the barrel back into the receiver, and slide the forearm over the magazine tube. Make sure the rear end of the forearm fits into its recess milled into the face of the receiver. Put the magazine tube cap on and screw it down hand tight. Ease the barrel forward to rest against the forearm. The barrel fit checklist involves the leading edge of the barrel extension, the rear of the forearm, and the magazine cap. When installed correctly, the barrel extension comes flush to the front of the receiver. On Magnums, the secondary shoulder of the extension is flush to the receiver. The rear of the forearm is inserted in the milled recess. The magazine cap should be hand tight. For some reason, I have had a number of shooters who

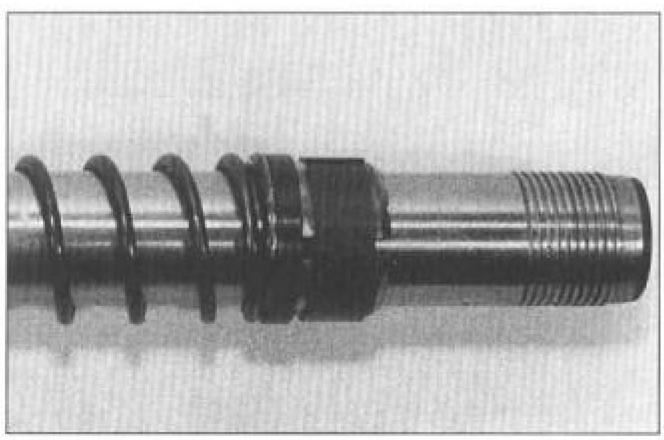
insist on leaving the magazine cap “a click or two loose” instead of tight. A loose forearm is more likely to crack.

Friction Rings and Magazine Tube

The heart of the Browning long-recoil system is the friction ring assembly. With enough friction, the action works without beating itself up. Too much friction causes malfunctions, and too little leads to excessive felt recoil, a cracked forearm and broken internal parts.

With your barrel and forearm off, look at the magazine tube and friction rings. Some Browning A-5's were made to chamber the 3-inch Magnum 12-gauge shells. Most of the Brownings, and all of the Remington M-11s and the Savage 720s were made for 2-¾-inch shells only. The standard-shell guns will have two friction rings, one of which is a two-part assembly. The steel ring is beveled in the inner edge like the beveled gas ring of an 1100, but is solid, and without a gap in it. The bronze ring is segmented on its inside face, and has a spring steel clip-ring around it. The bronze ring and its steel clip-ring each have a gap.

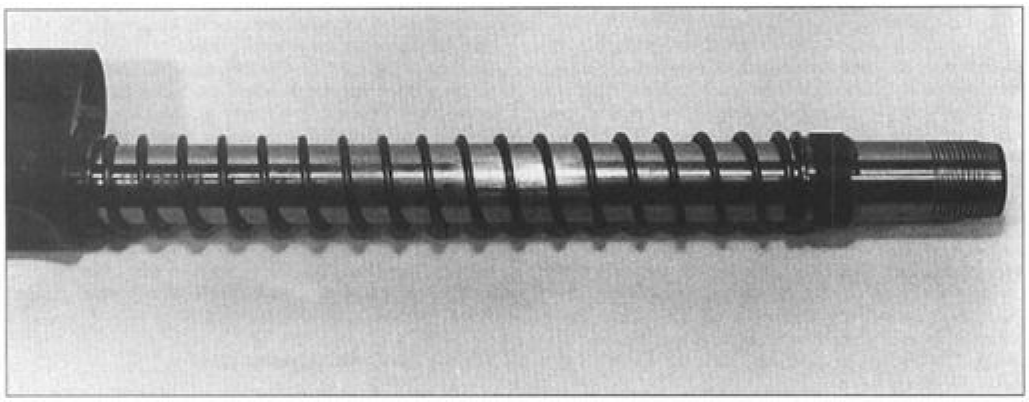
The 3-inch Brownings have five rings, three steel beveled rings and two bronze rings, smaller than the standard bronze rings, and lacking an encircling clip-ring.



This is the action set up for heavy loads. The steel ring is under the bronze ring, bevel towards bronze.

On the standard guns, there are three settings that all the literature mention, “heavy”, “light” and “lightest.” By far the largest number of guns

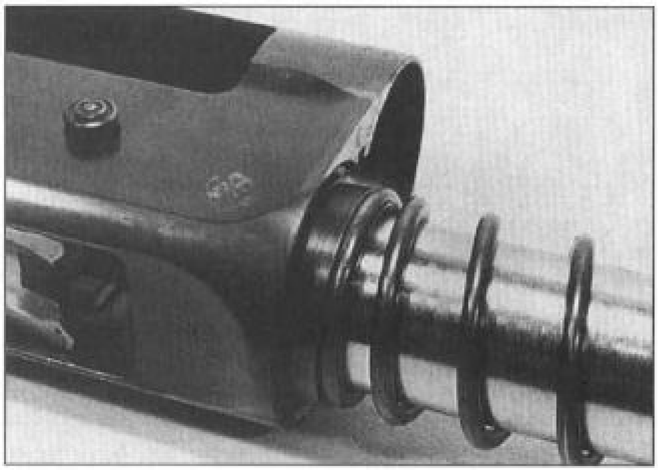
are left in the heavy configuration, and work well that way. The heavy configuration is with the recoil spring on the magazine tube, then the steel bevel-ring over the spring with the bevel towards the muzzle. The bronze friction ring with its steel clip-ring goes on next, and then the barrel hanger. Once the forearm goes on, the bronze friction ring is sandwiched in between the bevel of the rear ring and the bevel machined into the rear face of the barrel hanger.



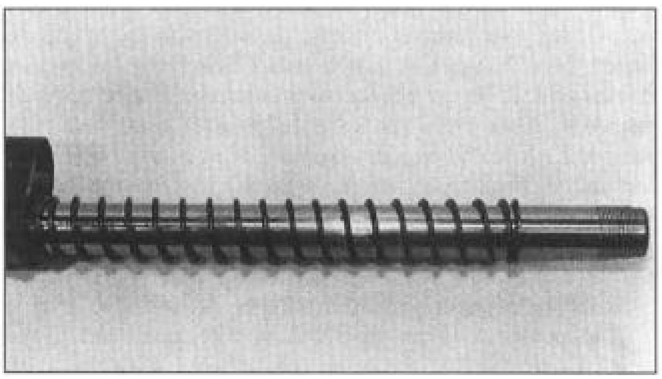
***Here the action is set up for light loads, with the steel ring against the receiver*.**

Upon recoil, the two bevels act to squeeze the friction ring against the magazine tube. The heavier the recoil, the greater the friction.

The other two settings for the standard guns are light and lightest. However, I have never had to use them. The light setting simply takes the steel bevel ring and moves it from between the recoil spring and the bronze ring to between the rear of the spring and the receiver. Obviously, back there it does nothing to influence the amount of friction. It rests there simply to keep it out of the way without losing it. I have never used it because every gun I have fired worked fine in the heavy setting, even with 3-dram target loads. However, if your gun does not cycle with light target loads and the friction rings set in the heavy configuration, change the rings. While I always had good luck with my various A-5s and clones (a total of nine guns I owned, and several hundred customers' guns) yours may be different. And, I test-fired them all with a 3-dram equivalent handload. You may be using a target load that is even lighter.



***The steel ring can be stored under the spring, against the receiver*.**



***In the tightest setting, used only with Cutts Compensators, the bronze ring is left off*.**

The lightest setting for the Browning A-5 action is meant for shotguns with a Cutts Compensator installed. The Cutts is an external choke combined with a recoil-reducing cage. The cage is considerably larger than the barrel, and has slots cut across it. The choke tube is screwed into the front of the cage. In the Cutts setting you remove the bronze ring entirely, and leave the steel ring in back of the recoil spring. (Why not store the bronze ring back there too? The bronze ring would prevent the barrel from recoiling all the way back in its proper stroke.) The extra weight of the Cutts unit is only part of the reason you have to decrease friction. When the wad and shot leave the muzzle inside the cage, their recoil-generating work

is done. When the wad and shot strike the choke, they jerk the barrel forward. On any other shotgun, the forward force would be imparted to the whole gun, dampening felt recoil. On the A-5 the force is imparted to the barrel, decreasing its ability to cycle the action.

Again, my experience has been counter to the descriptions in older manuals. I have worked with a few A-5s fitted with Cutts, and they would cycle property with 3-dram loads with the friction rings set in the light setting. If they worked in the light setting, I did not feel the need to change to the lightest setting.

Regardless of the load you are using and any recoil-reduction accessories you might have installed, you should set your shotgun up with the heaviest friction ring configuration that it will work with. Test fire your shotgun with the heavy configuration. If it cycles, you will not gain any advantage, and will risk cracking your forearm, by changing to a lighter setting. If it does not cycle, try the light setting.

The Magnum shotguns have five rings, and only one setting. Starting from the recoil spring and going forward, the array is: steel bevel ring with the bevel forward, bronze friction ring, steel bevel ring with the bevel back, steel bevel ring with the bevel forward, and bronze friction ring. The two bronze rings are squeezed by the bevels to grip the magazine tube tighter. The A-5 Magnum is different from the standard guns in more than just the friction rings. The barrel differs in the chamber, barrel extension, ejector and the distance from the barrel extension to the barrel hanger. The forearm is longer, to accommodate the longer stroke of the Magnum barrel. The recoil spring on Magnum guns is much heavier than the one on standard guns. On the Magnum shotguns there is only the one setting. Even taking out some friction rings you might not get a Magnum gun to cycle with standard loads. You cannot switch barrels between standard and Magnum guns.

Unlike the Remington 1100 or 11/87 which can be tricked into working with standard loads, the Browning Magnums won't switch back and forth between standard and Magnum, and cycle. The holy grail of shotgun design for the last few decades has been to make a model that will work with both loads without having to change anything but the ammunition.

Friction Ring Maintenance

Most of the maintenance of the friction rings is actually maintenance of their working environment, the exterior of the magazine tube. Of the A-5s that came into the shop with complaints of malfunctions, the problems could be summed up in three words: lack of cleaning. The inside of the receivers were always packed and coated with a disgusting mixture of oil, powder residue, dust and lint, and the dirt and debris that could fall in whenever the action was open. Even with receivers that dirty, the main problem was the magazine tube. If the lubricating oil hardened, or the outside of the tube oxidized, or the tube was left dry and without any lubricant, or had become scratched and scored from years of shooting, friction built up. Too much friction meant slow or short cycling, and a lack of semi-automatic function. The solution is simple, clean and polish the tube. Check to make sure your shotgun isn't loaded. Remove the magazine cap, forearm, barrel and friction rings. Ease the bolt closed. If you want to check your shotgun incrementally, you can try each step and test-fire. If you want to clean the tube and solve the problem, go to it. Incrementally, you would oil the outside of the tube, reassemble and test fire. If that fails, then disassemble, scrub the tube with steel wool, oil and test fire. The next step will be polishing the tube.

The procedure is simple. Disassemble the front half of the shotgun and scrub it clean in the parts washer or your cleaning part. Once dry inspect it. If it is oxidized or crusty with petrified oil, buff it with a wire wheel or polish it clean with a Scotchbrite pad. If the tube is scored or scratched (from debris stuck in the friction rings cycling back and forth on the tube) polish the tube with 220- or 320-grit abrasive cloth.

The friction rings also must be scrubbed and cleaned off with steel wool. Then, it is a simple matter to oil the tube, reassemble and test fire. Even A-5s with grunge-filled receivers improve their functioning after the magazine tube has been cleaned and buffed.

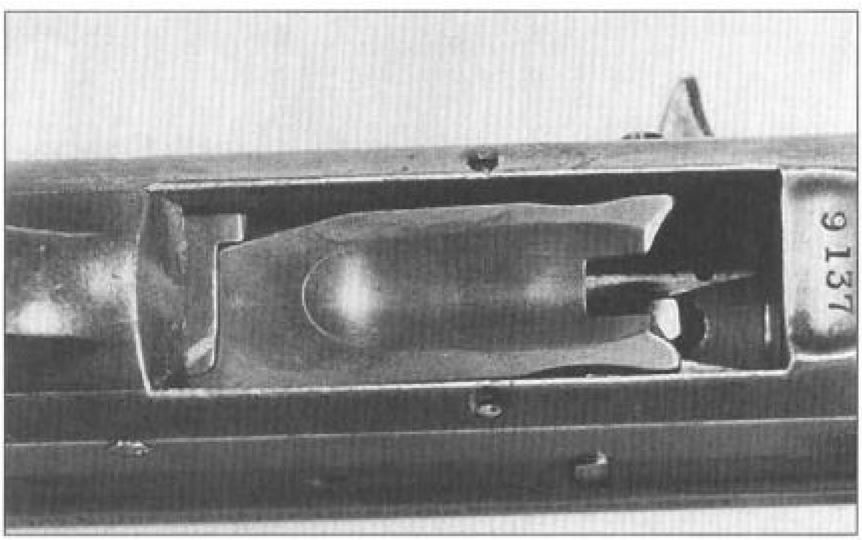
Your magazine tube should be clean and smooth. If you see irregular patches of slight discoloration, or dark swatches of hardened oil, you need to buff. To buff the tube, you can use power or do it by hand. With power, use a wire wheel and work with the wheel perpendicular to the tube. Run the wheel along the length of the tube, buffing the deposits off the tube. If your magazine tube had scratches or gouges along its length you will need to polish with 220 or 320 cloth. To polish the tube first clamp the receiver in a padded vise with the magazine tube sticking out into the room. Use the

cloth in a shoeshine motion, wet-polishing using oil or mineral spirits as a lubricant. I would shy away from using water as a lubricant. After all, you're polishing the tube in part to remove oxidation, and water promotes oxidation. Polish the tube from front to back completely around its circumference. Even if you only see scratches along one part of the tube, polish all the way around. You want to keep the tube circular in cross-section, and polishing only one section will make the tube slightly out of round.

Installing a Two-Piece Browning Lifter

The Browning long-recoil action, as with the 1100/11-87 action, locks open on each shot. The next round feeding out of the magazine tube unlocks the bolt, which then closes and chambers the shell. On the 1100 the bolt release button is the silver button in the middle of the lifter, while on the A-5 the bolt release lever is the button on the right side under the ejection port.

Here the two-piece lifter is in place. Notice the line between the front and rear halves of the lifter.



To load either the 1100 (as a comparison) or the A-5, you have two methods. You can lock the bolt open. If the shotgun is empty, simply pulling the bolt back until it locks will do the job. Place a shell in the chamber or on the lifter through the ejection port, press the button, and the bolt will close and chamber a round. On both shotguns, if you have the bolt already open

and you press the release to load a shell in the magazine, the bolt will slam shut.

Or, you can first load the round into the chamber by loading it into the magazine. On the 1100, pressing the shell against the lifter, and as a consequence the button, unlocks the lifter and allows you to press it into the chamber. On older A-5s it doesn't matter how hard you press against the lifter, it won't move. To release the lifter you have to press the release button on the side. With the lifter unlocked you can press the shell into the magazine. With either shotgun, once you have a shell in the magazine you can chamber it by retracting and releasing the bolt.

The need to press the release button in order to load the magazine was always viewed as a necessary detail of the mechanism. The Remington 11–48 has the same button. But subsequent Remington models used the lifter-mounted button, and the advantage was obvious. The Browning company re-designed the lifter on the A-5 to be a two-piece affair. The rear half locks the action open, and times the lifter to the next shell, as usual. The front half pivots out of the way for loading. Unless you want to close the bolt on an empty chamber, you never need to touch the bolt release button.

To install a two-piece lifter in your Browning, you need the new lifter and your Browning screwdrivers. Some guns with older springs may need a new lifter spring. You will not know if your old spring is too short until you try it. In the several dozen Browning, Remington M-11 and Savage M-720 conversions I did, only one came up short. The lifter spring is cheap, so you might just order one when you order the new lifter, just in case. Take off the buttstock and remove the trigger assembly. If your A-5 has the lifter spring inside the receiver instead of on the trigger assembly, press its tip down and away from its compression post and remove it. Remove the lifter screws and take the old lifter out. Install the new lifter with the two pieces together. Install your lifter spring. Before reassembling the gun, press the front half of the new lifter towards the bolt to check lifter function. Does the new lifter swing smoothly? Does it snap back when you let go? If the old spring is too short, when the lifter is pressed up the end of the spring will come off the cam shoulder of the lifter. Replace the spring.

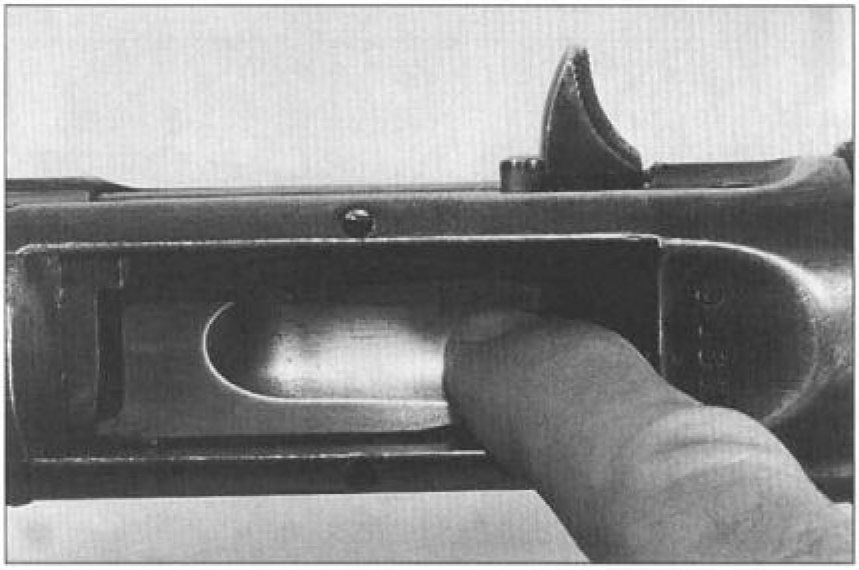
If the lifter does not move smoothly, it may be rough or slightly oversized, Take the lifter out and polish the sides. You can use a large polishing wheel in your hand-held grinder, or an abrasive cloth with a hard flat backer.

Polish the sides smooth, clean the lifter parts of abrasive grit and reinstall and check function.

Once the lifter moves smoothly, reassemble the trigger mechanism and the buttstock. Once this is done, your Browning A-5 no longer requires that you press the release button to load it. The bolt will still lock open when empty, but your loading chores are eased. All you have to do now is press the shells against the lifter, which pivots out of the way, and thumb them into the magazine. An added bonus of the two-piece lifter comes with the bolt locked open. If you have a two-piece lifter in your A-5 and the bolt is locked open, pressing a shell past the lifter and into the magazine does not slam the bolt shut empty, as it would on the A-5 equipped with a one-piece lifter or an 1100. Instead, you thumb the shell into the magazine. The bolt-mounted shell stop is not there to restrain it, so the shell gets launched into the mechanism as soon as your thumb releases it, the shell strikes the bolt catch, the bolt unlocks, closes and chambers the round. Your once-empty shotgun now has a round chambered, and has told you that's the only one available.

In a practical shotgun match, that knowledge can be very useful. If you had forgotten how many rounds you've shot since the start buzzer, loading a shell and hearing the mechanism go “ka-chunk” brings you right up to date.

The two-piece lifter is one of the parts (two, really) that can be exchanged between the Browning A-5, Remington M-11 and Savage M-720. By putting a Browning two-piece lifter in your Remington or Savage, you can bring it up to date.



***Pushing the lifter does not require using the lifter button*.**

For all of its industrial-tool construction and continued function under any circumstances, the Browning has one fragile part. The safety spring. If you have an older A-5 where the safety is in the front of the trigger guard, as in an M-1 Garand, you will be puzzled by the assertion that the safety is delicate. That one isn't. The later ones, the ones with the safety that is a push button behind the trigger, are the fragile ones.

***The safety on the Remington Model 11 is in the trigger guard*.**

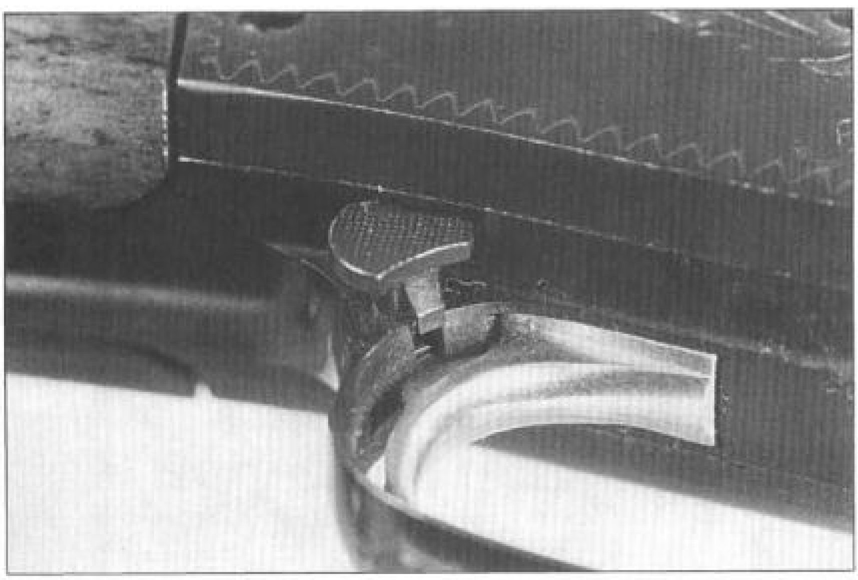
The safety button is held in place by a click ball that engages slots in the safety, and the click ball is powered by a small extension of the trigger spring.

If your safety flops back and forth, and will not stay in place, the spring is broken. The click ball has probably fallen out, too. Order a new click ball and a new trigger spring. When they arrive, disassemble your shotgun and remove the trigger assembly. Set the rest of the parts aside. Leave the hammer cocked for the moment. On the trigger assembly you will see the hammer spring extending back into the lower tang. The trigger spring is under the hammer spring and you will have to disassemble your way down to it.

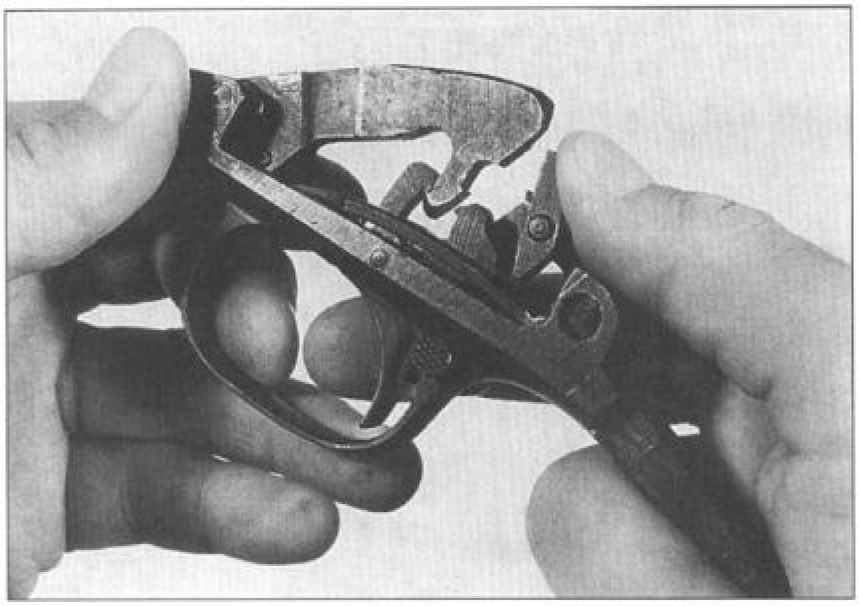
A brief aside on the function of the Browning A-5 and its clones. On the top of the trigger assembly is a small post that rocks back and forth. It is powered by a spring and plunger underneath. It is called the safety sear. The safety sear in its pushed-back position blocks the trigger and keeps it from moving. Now look into your receiver at the action bar. The action bar is slotted for two reason. One, to give the hammer clearance to strike the firing pin. At the rear of the action bar slot is a bevel. When the bolt is completely closed, the bevel tips the safety sear forward, and clear of the trigger. If the bolt does not fully close, the shotgun will not fire. Start your trigger system disassembly with the safety sear. The safety sear has a small shoulder underneath that keeps it from sliding off of its pivot post. Reach

underneath its forward extension and depress the plunger with a small screwdriver. With the plunger held down, slide the disconnector off its pivot shaft. Ease the plunger and spring out of the hole.

Place a thumb in front of the hammer. Press the safely off and then pull the trigger. Ease the hammer all the way forward. Once the hammer goes all the way forward it will lose contact with the hammer spring. With the tension off of the hammer spring you can now remove the hammer spring. Notice the curve of the spring. It goes into the assembly one way, and you want to get it back correctly (slightly curved down) upon reassembly. Had you tried to loosen the hammer spring screw without relieving its tension you would have knarfed the screw slot, and maybe stripped the threads on the screw.



If there is a weak spot of the Browning, it is the spring that works the safety button. (Clue: John Browning didn't design it.)

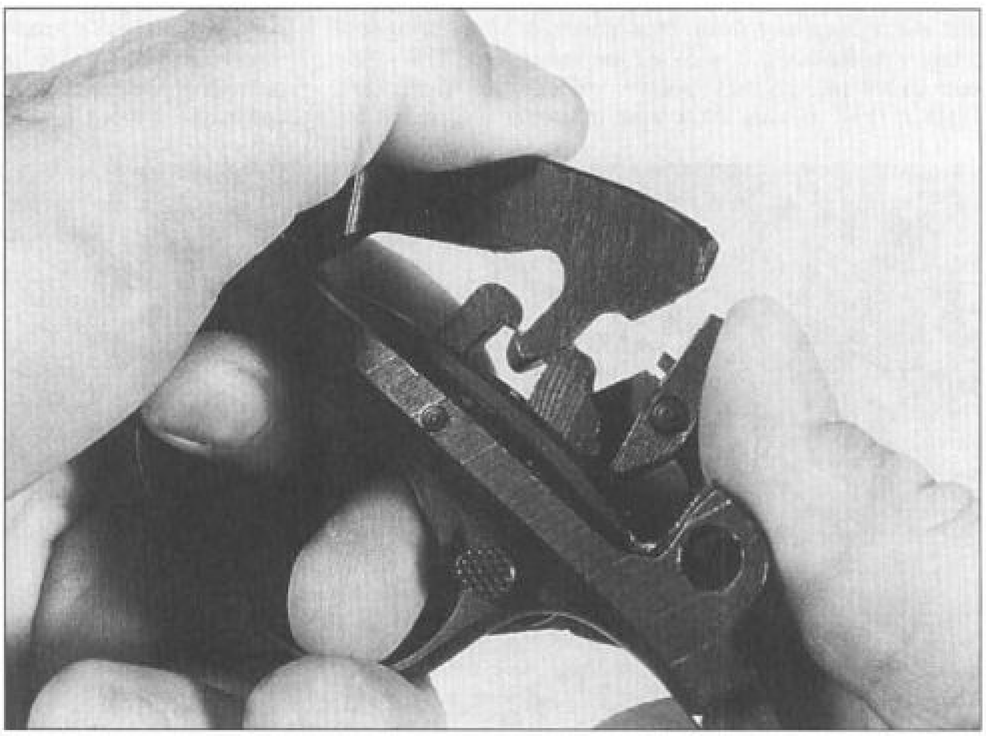


This is the safety sear. In the shotgun, the safety sear is tipped forward by a shoulder of the bolt link. Only when the bolt is fully forward will the safety sear be tipped forward, as my thumb is doing now. If the sear isn't tipped, the shotgun will not fire.

Once the screw comes loose lift the hammer spring free. It encircles the trigger hooks, and you will have to do some wiggling to lift it from its slot in the tang and work it off the trigger, but it will come out. Now you can finally see the safety/trigger spring. The front end has three fingers, the outside ones power the trigger and the center one pushes the click ball. If your safety has been inoperative, the center one is cracked or broken. Sometimes the center finger falls out and the click ball goes with it. (I have no idea how they can work their way out of such tight confines, but I have opened up more than one Browning to find them missing.) The rear of the spring has tabs that ride in slots in the lower tang. Press the rear of the spring back and out of the tang. If you have to replace the click ball, drop the new one into the hole and slide the new spring into the tang. Line up the clearance hole in the spring with the screw hole in the tang. Check the function of the safety. It should click back and forth just fine. Work the hammer spring back into place and tighten the screw. Cock the hammer. Place the safety sear spring and plunger into the hole, slide the safety sear onto its shaft, and then depress the plunger enough for the safety sear to slide the rest of the way home.

Cock the hammer. To check the function of the safety, hold the trigger assembly in your right hand as if your were firing it, and place your left thumb in front of the hammer. Push the safety to “on.” With your right thumb tip the safety sear forward and while holding it in place, pull the trigger. The hammer will not move. Release the trigger, press the safety to “off and pull the trigger again. The hammer will move forward. Re-cock the hammer and finish reassembling the shotgun.

When you fire the Browning, you hold the trigger down. The returning hammer catches on the rear hook and is held there until you release the trigger.



When you release the trigger, the hammer jumps forward, only to be caught by the front hook. (The safety sear is in its “safe” position here, blocking trigger movement.)

Trigger Work

I have never seen a Browning, Remington or Savage that needed trigger work. The reason is the innovative Browning “double-hook” trigger mechanism. At first glance, experienced rifle shooters will point to it and exclaim, “A Garand trigger!” Nice try, but Browning had invented it 20 years before John Garand began work on a semi-automatic rifle for the Army. In fact, Browning had used the same design on the rifle he designed for Remington, the Model 8. The Model 8 is essentially a rifle-caliber Auto-5. The same long-recoil mechanism, and the same double-hook trigger.

Cocked and ready to fire, the hammer is held by the front hook of the trigger. The front hook is a solid extension of the trigger. The rear hook is a pivoted and spring-loaded part of the trigger. To fire, you pull the trigger, which tips the front hook away from the hammer. The hammer slams into the firing pin, setting off the cartridge. During recoil the bolt rides back, camming the hammer back. Your finger is still holding the trigger back, tilting the hooks forward. The hammer pivots the rear hook of the trigger back, and the trigger hook spring snaps it over the rear hook of the hammer. Once the bolt is closed, you release the trigger. The face of the rear hook is slightly closer to the trigger pivot than the front hook Face is. When the

hammer slips off the rear hook, it is captured by the front hook and held cocked.

The rear hook takes the major force of the hammer spring as the hammer swings forward, having been cocked. The front hook only has to hold the hammer back once it is cocked. The beauty of the system is twofold: the pivoted rear hook moves out of the way when the hammer is cocked and your trigger finger never feels it, and the front hooks can be shallow and well-polished for a light trigger pull because they do not have to deal with the full-force impact of the cocking hammer.

(As an aside, one of the difficulties of making the Remington 870/1100 trigger cleaner and crisper is that it is a single-hook design. The sear notch in the hammer must do double duty, both catching the hammer after full cock, and holding it for the trigger release. To be and remain safe, it must be a deeper notch than the Browning can be.)

The design is so good Browning used it on the Model 8 and 81 rifles. Garand used it in his rifle design, and the U.S. Ordnance Department kept it when they upgraded the Ml Garand into the M-14. Even the AK-47 uses a variation of the double-hook mechanism.

The only thing you need to do to keep it running is to clean and oil the trigger assembly, and put a little dab of Chip McCormick's Trigger Job on the front hammer and trigger hook.

Installing Scope Mounts

Putting a scope on the Browning is not easy. Obviously, the barrel is out as a mounting location. Even if you could get a scope mount that would stay on during the back-and-forth motion of cycling, could you get a scope to survive? (And I'm not convinced you could keep the mount on.) The extra weight would not be a problem for the shotgun, as you could adjust the friction rings to keep it cycling.

No, if you want a scope on an A-5 you have to mount it to the receiver.

The reversible method is to use a saddle mount. By replacing the trigger assembly screws with longer ones, you can clamp a “U” shaped mount over the receiver, a mount that has a rail on the top.

The other method is to drill and tap the receiver top for a scope mount. During the development of scope-mounted shotguns for the slug event at Second Chance (R&D that paid off when I later had customers coming in wanting scopes on their hunting shotguns) I used the “belt and suspenders”

method of attaching a scope mount to an A-5. The receiver of the A-5 and its clones is thin shell machined from a large block of steel. In addition to drilling and tapping, I used epoxy to keep the mount secured to the receiver. The best kind is the Poly-Choke rib adhesive, as it is not brittle. By slightly flexing, it maintains its bond between the receiver and mount. Despite vibrations, solvents, heat and cold, the Poly-Choke adhesive will stick. Harder epoxy formulas can crack and chip off of the mount or receiver.

***A Browning with a scope mount attached to the receiver. This one is drilled, tapped and welded*.**

Once the holes have been drilled and tapped and the screws shortened and fitted to the receiver, you are ready to attach the mount. As with any epoxy bond, thoroughly degrease the parts before mixing and applying the epoxy. Run a bead of epoxy along the bottom of the mount, and press it into place on the receiver. Tighten the screws. Use a card to wipe the excess epoxy away from the edge of the mount and receiver. Once it has set, install the scope rings and zero your shotgun with its slug barrel. Once done, the shotgun will always be a slug gun until you wrestle the mount off.

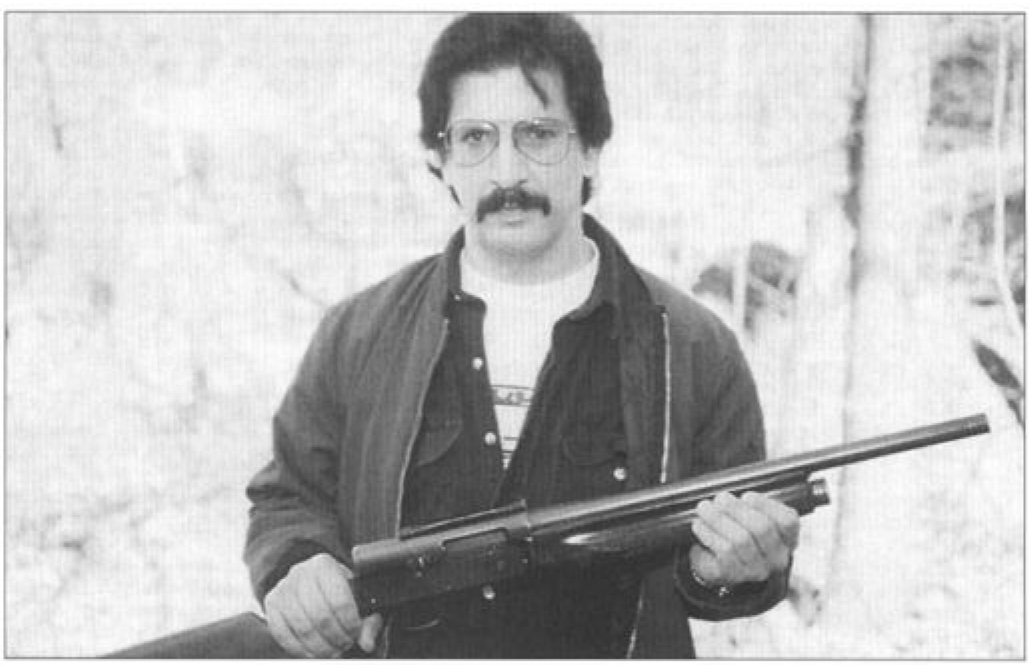
One Final Note

In the early decades of the 20th century, the Browning was made in gauges and shell lengths we don't now consider standard. The most common was the 16-gauge 2-9/16-inch shell. In the middle decades of the 20th century it was common for gunsmiths to convert these guns to the common 2-¾-inch chambering. It takes more than simply running a chambering reamer a little deeper into the chamber to properly convert a short Browning.

In the latter decades, with many guns already converted, the job became much less common.

If you have a short-chambered Browning, you would be best off if you sent it to a specialist to have the conversion done. I once worked on a poorly-converted 16-gauge Browning, and while inspecting it had one of the very few accidental discharges I've ever had. The toad of #6 shot nearly broke the heavy-gauge sheet metal box around the fuse box.

There is an appreciable amount of machining that must be done, and the forearm has to be precisely inletted to allow the change to work properly. Do the gun and yourself a favor and send it off.



George and the dragon. A short (but legal) barrel, and a low-power scope are perfect for bucks in the cedar swamps.

Chapter 18
Building a Turkey Gun

Turkey hunting is not like other hunting. Unlike other types of bird hunting, you don't take turkeys on the wing. Unlike squirrel hunting or other still-hunting adventures, you don't move. While deer hunters wear hunter orange for easy identification, every turkey hunter out there is camouflaged to the gills. If a turkey hunter does not blend in with the forest litter like any other mossy stump or Force Recon sniper, he won't be a successful turkey hunter.

You see, turkeys aren't dumb. In addition to being a bright bird, they are wary to the point of paranoia. Benjamin Franklin even suggested that the turkey be the national bird, instead of the eagle. I have a couple of problems with that idea. Had the turkey been named our national bird, it would be endangered instead of the eagle, and turkeys are tasty. (I have no idea what an eagle tastes like.) And two, the symbolism of an eagle swooping down to visit retribution is much more powerful than that of a turkey doing the same.

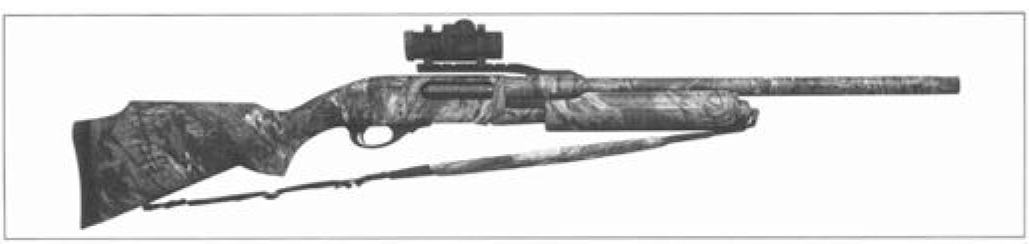
In order to hunt turkeys, you need every edge. A successful turkey hunter is one who is camouflaged to the point of invisibility, who can call a wary bird close and into the clear, and then can shoot it in the head. The turkey is tasty, and finding pellets with your teeth is painful. To ensure that a head shot is successful, the tightest possible pattern is needed. With such a tight pattern you have to be able to accurately aim. And, to stay hidden, the shotgun itself must be camouflaged.

What Type of Gun?

A turkey gun can be of almost any type. A single-shot shotgun will do, provided it patterns well. A pump or auto offers a quick follow-up shot, and a little more mass than the singles-shot, to help deal with the recoil. A gas-operated autoloader will further soften the felt recoil, an important consideration with the typical turkey load. The one shotgun usually left out of consideration is the double. Pattern overlap and center coincidence with the bead is easy to ensure when regulating the barrels and you are measuring your patterns with a 30-inch circle. With the super-tight turkey chokes, most doubles will not put both barrels to the bead. As a result, most

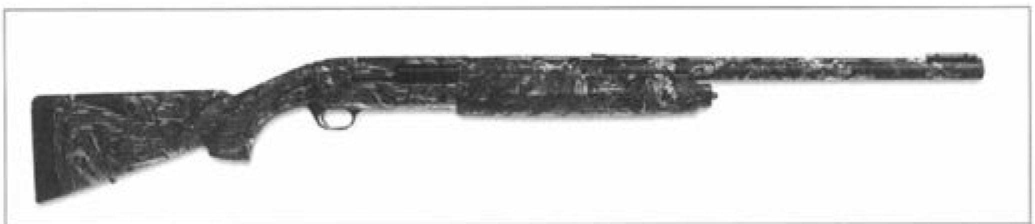
doubles end up as single-shots, using the one of the two barrels that comes closest to the bead or sights.

If you're going to be a successful turkey hunter, you start by camouflaging yourself. The camo and insulated clothes are a start, then you have to cover your face, hands and shoe soles (yes, your shoes!). Then, the gun.



Using a red dot scope can refine your aim. Be sure and cover the scope with camouflage, too. (photo courtesy Remington Arms Co.)

One action type that doesn't seem to get selected much is the bolt-action. Probably because the older bolt action shotguns are viewed as cheap, and current bolt-action shotguns are made for slug shooting. However, a durable bolt-action shotgun with barrel walls thick enough to handle screw-in choke tubes, could be inexpensively built into a turkey-killing machine. After all, quick follow-up shots are not typical in turkey hunting. Since the barrel is screwed into the receiver on a bolt-action, attaching the rear sight to the receiver does not add aiming error as it does on a pump or auto.



This Browning Gold comes already camouflaged for turkey hunting. (photo courtesy the Browning Arms Co.)

The turkey gun uses a special turkey load. Instead of a large payload of large shot as in duck or goose hunting, or a small charge of small shot as in clay bird competition, turkey loads are heavy loads of relatively small shot. A “typical” load has changed a little in the last few years. As shotshell manufacturers developed turkey loads, and turkey hunting became more popular, payload weight went up. Typical 3-inch shell pay loads started at 1-⅝ ounces, and the weight had crept up to 2 full ounces by the mid-1980s.

A shotgun shell is a balance of payload weight, velocity, and chamber pressure. Since pressure has an absolute limit, an increase in weight meant a decrease in velocity. The higher weights had a hidden limitation: velocity loss at distance. A hunter could find that a super-heavy payload held a tight enough pattern farther than the pellet energy could kill a turkey. To increase velocity required decreasing payload. The high-velocity turkey load is now around 1-¾ ounces in a 3-inch shell. The 3-½-inch shell rescued the super-heavy payload. The 3-½-inch shell not only has more room for its payload and propellant, but it has a higher operating pressure than the 3-inch shell. (The 2-¾-inch and the 3-inch shell have the same pressure ceiling.) Often

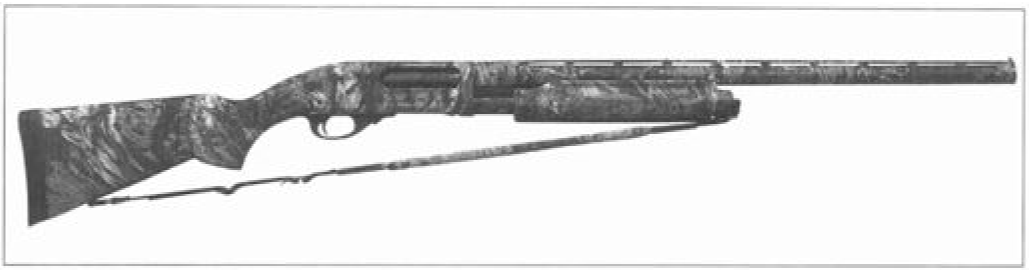
the shot will be hardened and plated, to reduce fliers and keep the pattern tight.

The shot size is within a narrow range. The smallest shot commonly used is #6, with the largest being #4. If you use a shot size smaller than #6, you get a pattern so filled with shot that it seems nothing could escape. Unfortunately, the pellets are too small to carry their energy. Pellets are spheres, and spheres lose their energy quickly. Sixes are the smallest pellets that will carry a killing level of energy all the way through the effective range of the choke. At the top end, #4 shot is the largest that will reliably fill a pattern all the way out to an effective range. If you go to a larger shot size, the pellets carry their energy well, but there are fewer of them and you can't be sure your pattern will be filled, with enough pellets in the head and neck area to kill the bird. With larger shot you could fire, center the turkey's head in your pattern, and not touch him because of the sparse pattern due to the fewer pellets. The loads with #5 shot are for hunters who can't decide between the #6 and #4.

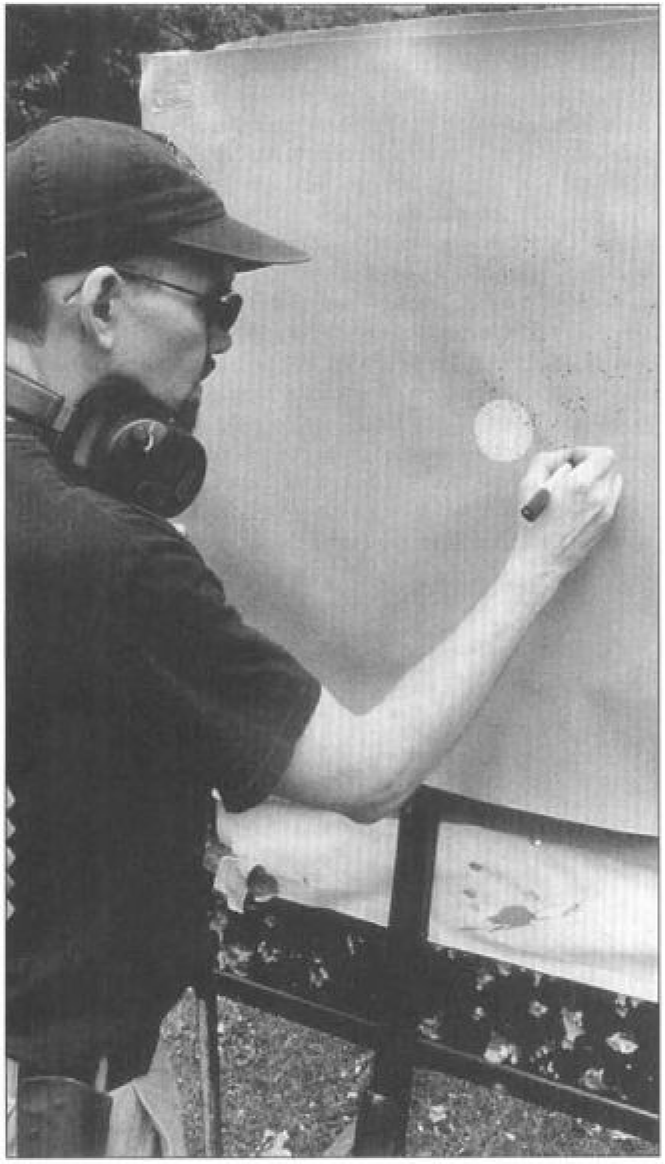
If you need a quick follow-up shot, a fast pump like this Winchester 1300 will be a good choice. (photo courtesy US Repeating Arms Co.)

The choke is the defining aspect of the turkey gun. No other choke or shotgun delivers as tight a pattern as a properly-working turkey choke does. For correct performance, turkey loads require Full or Extra Full chokes. If your shotgun is already choked Full, you can probably use it as-is if pattern

testing shows it delivers the goods. If it does not pattern to the needed level, or is choked more open than Full, you'll have to go with a screw-in choke system, as there is no way to tighten a choke, only to open it.



Properly sighted-in and using ammo that hits to the bead, a shotgun with "only" a bead sight is good enough to hunt turkey with. (photo courtesy Remington Arms Co.)



If you plan to use a double as a turkey gun, pattern to see which barrel is closest to center with its pattern.

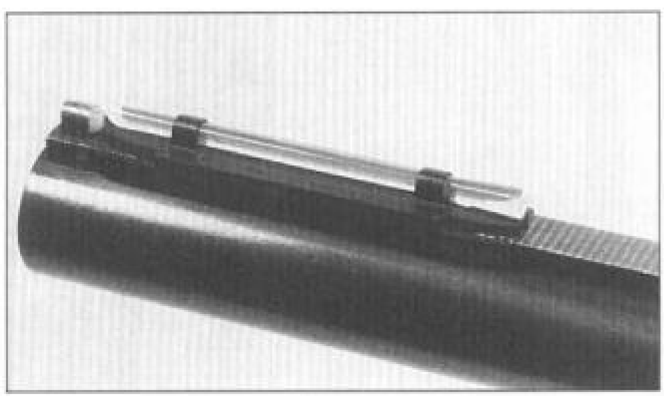
The turkey gun is not used as a wingshooting gun, so the number of pellets that are in the 30-inch circle at X yards is not the measure you use. Instead you measure a choke by the distance you can still put enough pellets into the head of a turkey.

The super-full turkey chokes are not simply a tighter version of standard chokes, but usually have a long parallel section. To gain the longer parallel, and ensure that the constriction is not too abrupt, many chokes tubes

designed for turkey use are longer than standard so long they stick out of the barrel. The protruding choke section gives the designers more room to constrict the shot, and the portion outside of the barrel can have thicker walls than if it were entirely contained. Thicker is stronger when it comes to choke tubes. To aid a little bit in dealing with the recoil, some turkey choke lubes are ported. The ports jet the propellant gases out to the sides and dampen the felt recoil a bit. They can't do a lot, but when you're launching a turkey load every little bit helps.

In addition to the tight parallel section of the choke tube, turkey chokes sometimes have straight rifling. The rifling serves two purposes. One, it keeps the wad from squirming around as it passes through the constriction. Second, the rifling acts as a partial extra-extra Full choke. By further constricting part of the payload, the choke delivers a tighter pattern without the risk of over-constriction and blown patterns.

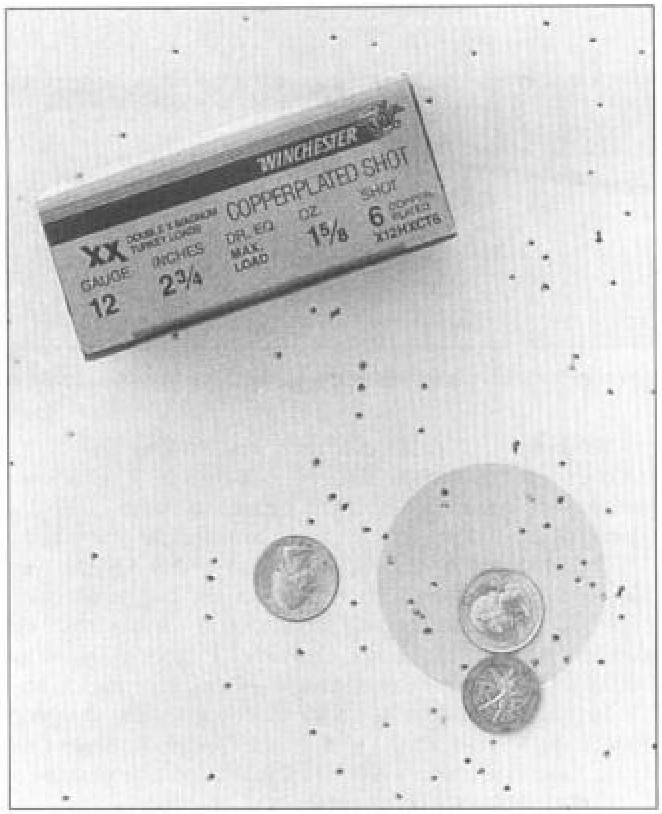
Performance Testing



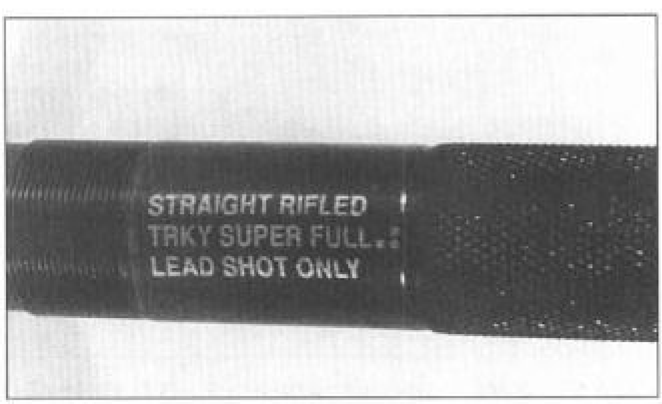
Magnets hold this Hi-Viz sight onto the rib. It is durable, effective and it stays in place.

Before you can test your pattern, you have to determine what the payload is supposed to do. You want to deliver a swarm of shot to the turkey that is so dense that a certain number will strike the head. And those pellets must get there with enough energy to cleanly kill the bird. I have heard some advocate as few as three pellets in the head-sized target area, but I feel comfortable with more. When using #4 shot, I insist on at least four pellets at a minimum, and when using #6 shot I hump that up to five pellets. If I

can find a #4 load that delivers five pellets from a particular shotgun, then that would be the one to use.



The Winchester #6 turkey load delivers a dense pattern, provided you stay within your choke's limits. This pattern, fired at 65 yards, is not dense enough. Many hunters think they have 55-60-65-yard turkey guns, but have never patterned them. You must pattern to be sure.



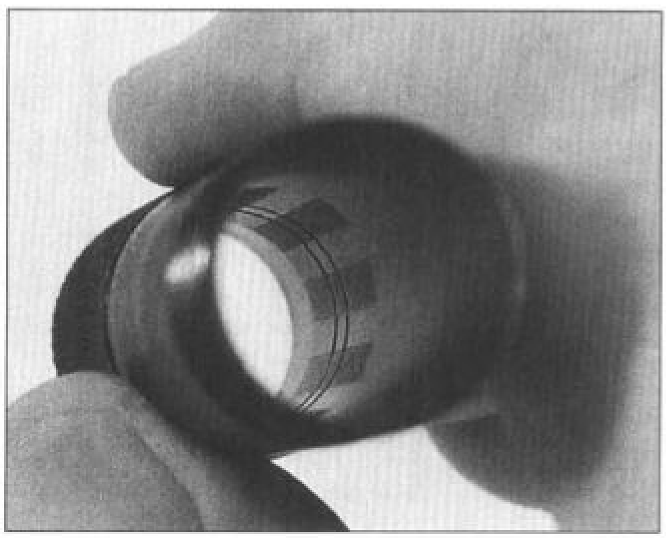
So long as it makes the pattern tighter, there is no such thing as a choke that is too tight. Remember, lead shot only.

And the shotgun must deliver this level of performance consistently and to the full range you are using as your maximum. Just because you tried a shot at 70 yards and had three or four pellets stray into the head of your turkey target, doesn't mean you are shooting a 70-yard load, or using a 70-yard gun.

Many shooters prefer to use a turkey target, but I shoot on plain paper. The idea is to test the pattern performance, and for the bulk of your testing plain paper will do just fine. Once you have settled on a load and choke combination, and have adjusted your sights, then practice on paper turkey targets.

To check the pattern of your shotgun, you need a target frame, the loads you will be testing, and a shooting bench. A bunch of padding will make the job easier. To evaluate the pattern, you need a turkey equivalent of your pattern circle. Except that where the regular pattern circle is 30 inches across, the turkey one is much smaller, I took a piece of card stock and cut a quarter-sized hole through it. You can make your “turkey head” from card stock, light board or clear plastic. Start with your target frame at 30 yards. If you are testing several different loads, don't worry about the sight settings. Only after you have decided on a particular load do you have to worry about adjusting your sights.

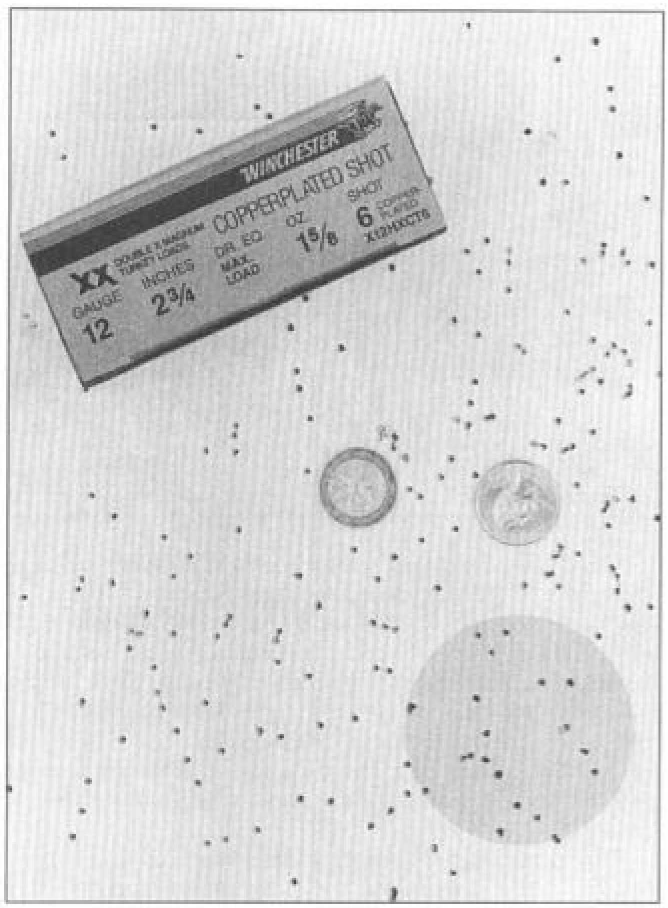
The payload of a turkey load needs more choke than a short choke tube can deliver without stress. For proper performance, go with the longer tubes.



Some turkey choke tubes will have straight rifling for tighter patterns. The only question for you is, does it work in your gun? Pattern testing will tell.

Settle down at the bench and fire one round onto the paper on the target frame. Walk down and put your pattern overlay over the center of the pattern. Are there at least five hits? Then you are still within the effective range of your load and choke combination. Move the frame farther out and

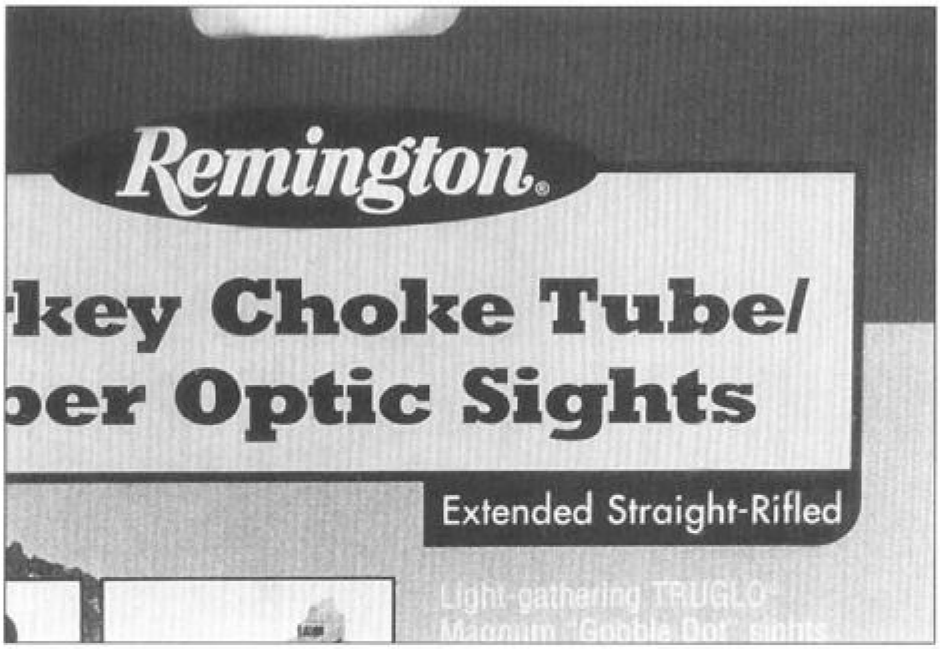
test again. If the pattern does not deliver the necessary five pellets in the turkey pattern circle, in the center of the pattern, you have gone too far. When you find the outer limit, where it is all the gun can do to deliver five pellets every time within the "turkey head", you are done. Serious turkey hunters will not use a single test pattern to determine the limit, but fire five shots. Each of the five shots must deliver enough pellets to the pattern at the maximum range, or they try a few yards closer. Once you have determined the maximum distance at which your shotgun and the load being tested deliver the goods, subtract five yards as insurance against Murphy's Law ("anything that can go wrong, will") and you have the maximum effective range for your gun with that load.

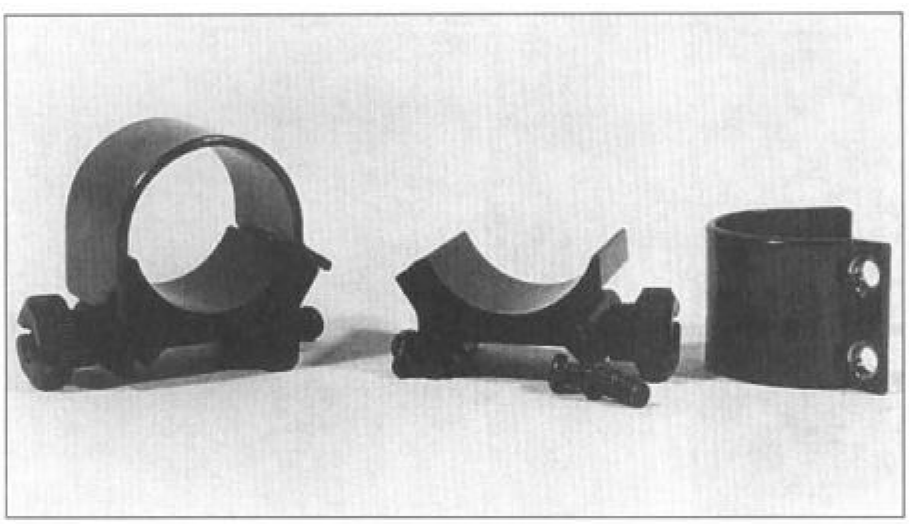


Check the pattern with either a turkey target or plain paper, but check the pattern. This pattern is not dense enough, but as a 60-yard pattern goes, not too bad.

More pellets in the circle is better, but five #6s will do. However, if a branch or leaf is in the way, your five pellets may not arrive. That's why it must be five pellets every time you pattern test, (not just “most of the time”) and minus five yards for insurance.

For the benefit it delivers, you'd think the “straight-rifled” script would be larger. It does work, you should get it.





Weaver rings will hold a scape or red-dot in place, and not add muck weight.

Once you have a load selected, then adjust your sights so the center of the pattern and the front bead or crosshairs of the scope coincide. Practice until you can hit the head every time, and you know what your maximum range looks like.

Precision delivery of the pellets is a must. Some turkey hunters go with scopes, both for target identification and precise aiming. Scope mounting is covered in the next chapter, on building a deer gun. The methods of mounting a scope and the desired results are the same, whether for a deer or turkey gun.

However, not every hunter wants a scope on his shotgun. For the iron-sight shooter, the latest improvement is fiber optics. Instead of using dots of brightly-colored paint to aid aiming, the sight makers have developed methods of holding short tubes of plastic in the sights. The tubes do not let light escape from the sides of the tubes, and all tight gathered by the tube is sent straight out the rear of the tube. In any kind of light the sights glow brightly.

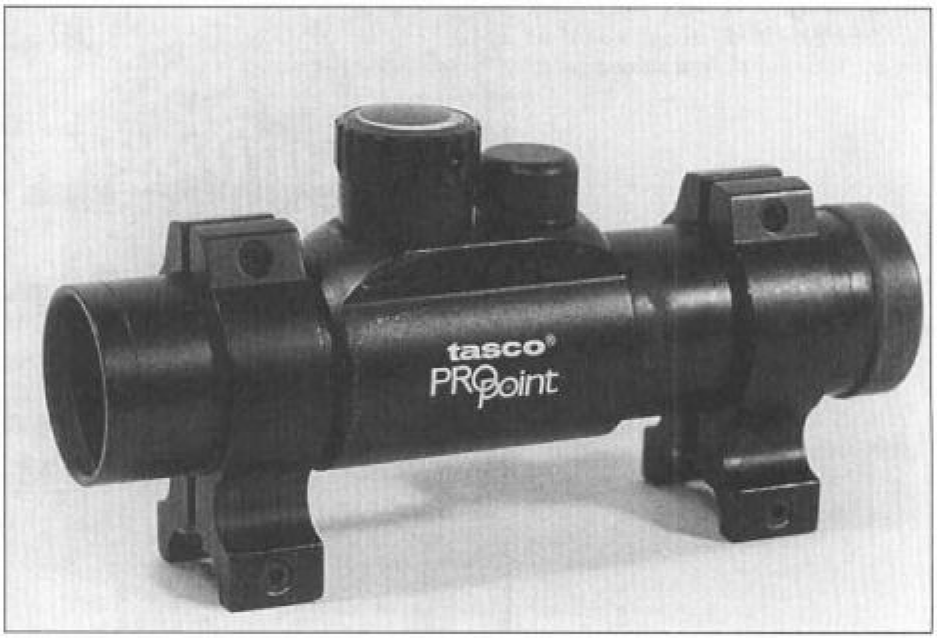
The basic models replace the iron sights that came on your barrel. For those who have a vent rib, the replacement sights can be glued or screwed to the rib. There is even one replacement fiber optic sight that clamps around a plain barrel.

The customary design of the fiber optic sights is to use a front bead on the front sight blade, and two beads on either side of the rear notch. The sights can replace the iron sights, or they can be attached to the rib. The fiber optics replacements for iron sights are more likely to be used on a deer gun, simply because a deer gun is more likely to have iron sights to start with. However, if you're using a deer barrel with screw-in choke tubes, it can be used for turkey hunting. Swap the rifled choke tube used with slugs for a turkey extra-full, adjust the sights for the turkey load, and you're ready to go.

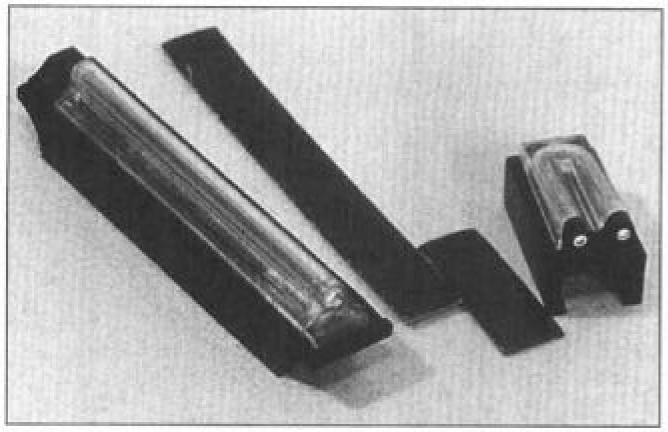
Another approach would be to install a front sight with a fiber optic dot in it, and use a ghost ring rear. While the ghost ring would not be nearly as bright as a fiber optic rear blade, the longer sighting radius would aid in aiming. And by swapping the turkey choke back to the rifled choke tube, you'd have an accurate deer gun.

Once installed, you sight them in as you would any other sight. Adjust the sights so your sights and the pattern center coincide at the maximum effective range for your gun and load.

A red-dot scope can greatly improve your odds of connecting once you've lured a turkey into range.



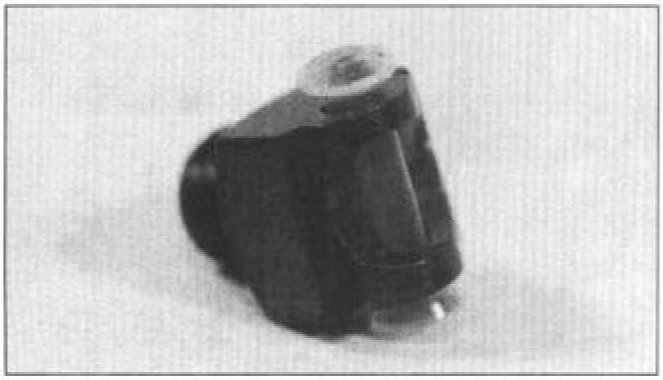
Turkeys have good eyesight. In fact, they seem to have radar. If you are huddled in your camo getup, sitting behind a small bush, all your efforts are for naught if your shotgun is blue steel and wood or plastic. It has to be camouflaged as well as you are. Better, because the barrel is a straight line, and nature is very sparing in her use of straight lines. One method of camouflage is covered in Chapter Ten, Blueing. By using various colors found in nature, you can paint your shotgun into disappearing. One advantage to using paint is the ability to adjust your pattern. If you find that the foliage is lighter or darker than your paint job, then you can make a quick adjustment at the hunting camp or cabin.



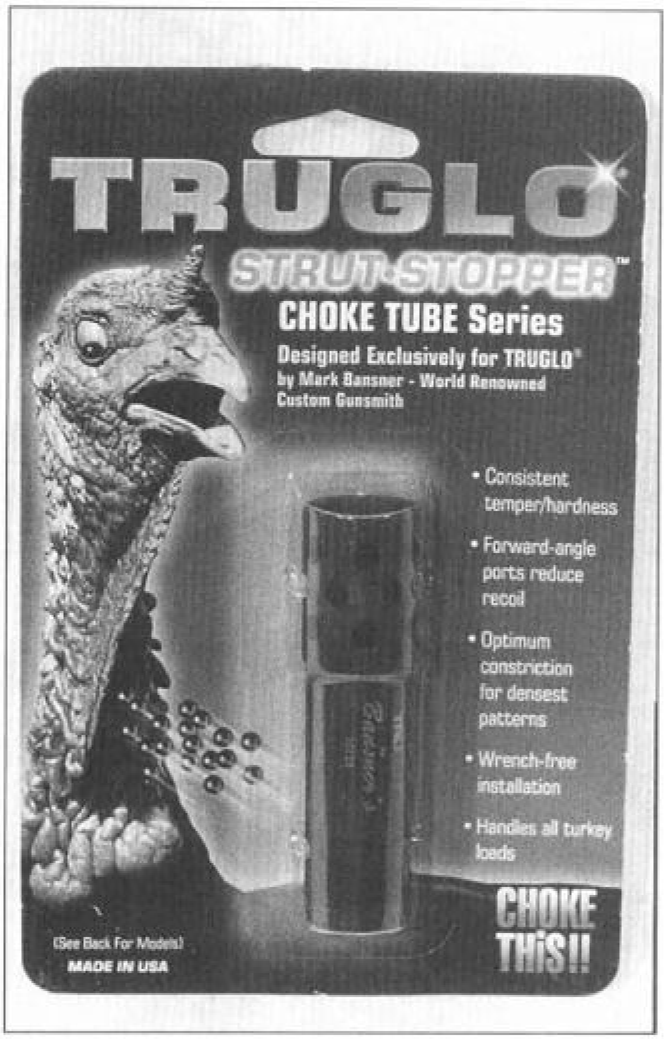
This Tru-glo sight set uses adhesive to bond to the rib. Be sure your rib is clean, degreased and dry before applying the sights.

Paint, for good or bad, is relatively permanent. Once you've painted your gun, it is tough to remove the paint. You have to use paint strippers, and many of them will lift the finish off of a wood stock and forearm. If you don't want to mess around with paint, or want to be able to turn your shotgun back into a civilized skeet gun when you are done, then one of the adhesive-backed camo covers is what you need. Printed with any one of a bunch of camo patterns, and backed with adhesive, you can apply the pre-cut sheets to your shotgun and then peel them off later. For the hunter who wants to have a camo gun for hunting, but doesn't want a camo gun at the gun club, what could be better?

When you have the cover on hand, first check its fit. Wipe the shotgun down and pull the cover out. Leave the backing paper in place. Try folding and bending the pre-cut parts overyour shotgun. If you find that an area doesn't quite fit, mark it with a pencil. You can trim with scissors or a sharp knife before you apply it.



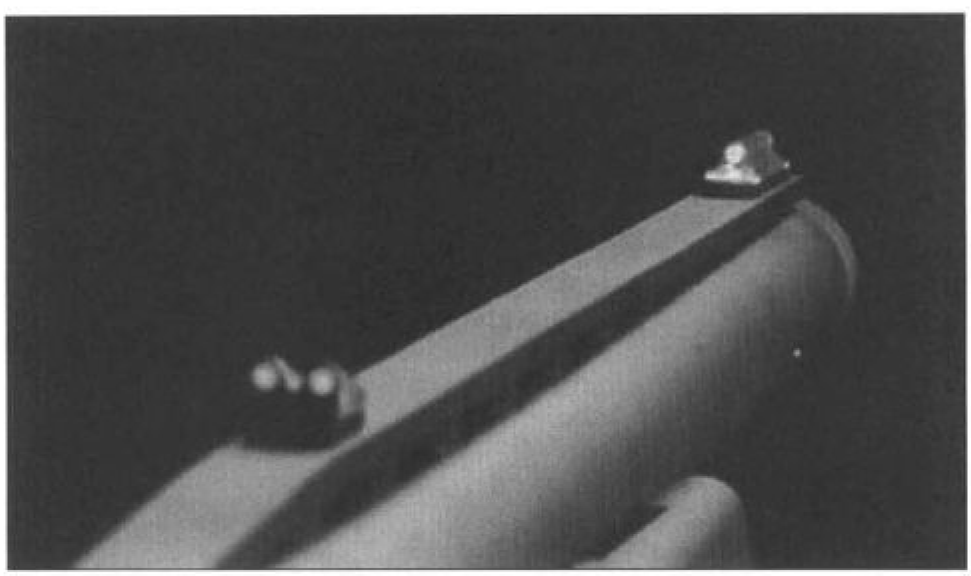
A fiber-optic front bead is a nice step up from a brass bead, but you should have a rear sight, too.



Truglo makes sights and chokes. This specially-designed choke (by Mark Bansner) not only delivers a tight pattern, but is ported for recoil reduction.

To apply, wipe the gun down with a clean dry cloth. The adhesive will stick even if there is a little oil left behind, the amount left by a soft, dry cloth. Any more oil, and your camo cover won't adhere. Take each section of the appliqué in turn and peel the backing paper off. Then apply it to the designated section of the shotgun. With the first piece in place, peel and apply the next one. Once the cover is in place, you may need to keep the edges under control, and cover bare spots. Use the scrap section left from the cover and the trimmed sections to fill in any gaps. If a section begins to lift after hard use, take some flat black electricians tape and hold the edge down.

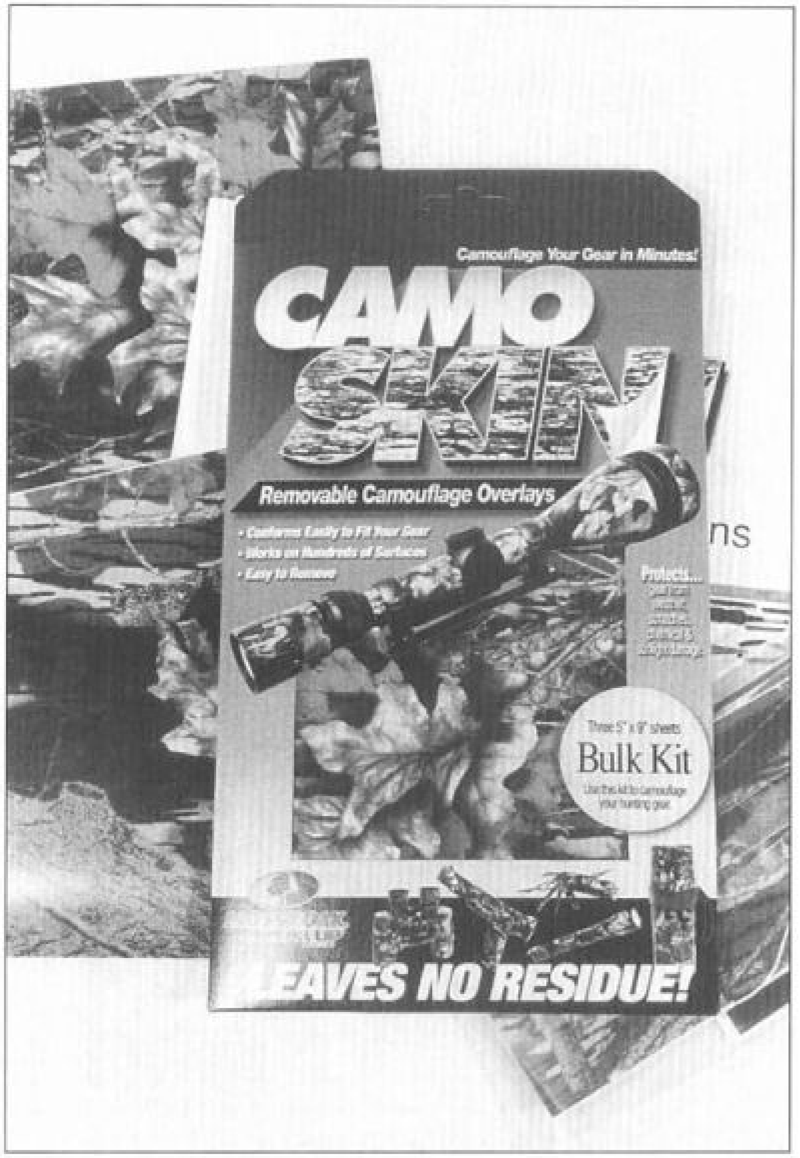
Take care to keep the cover clear of the safety button. You don't want the camouflage getting in the way of proper safety use. If your barrel is ported for recoil control, get a new X-acto knife blade. Carefully cut through the cover at each of the holes to provide a path for the gases. If you do not clear the ports, the first shot will peel the cover off. Another approach to providing clearance is to cut the cover away around the ported area before you apply the cover. Then use a short spurt of camo spray paint to hide the small section of blue steel. When you clean the cover off after the season, it is easy to use a paint stripper to remove the small section of paint from the steel.



With Truglo sights on your shotgun, if there is enough light to see the bird, there is enough light to see the sights. (photo courtesy Remington Arms Co.)

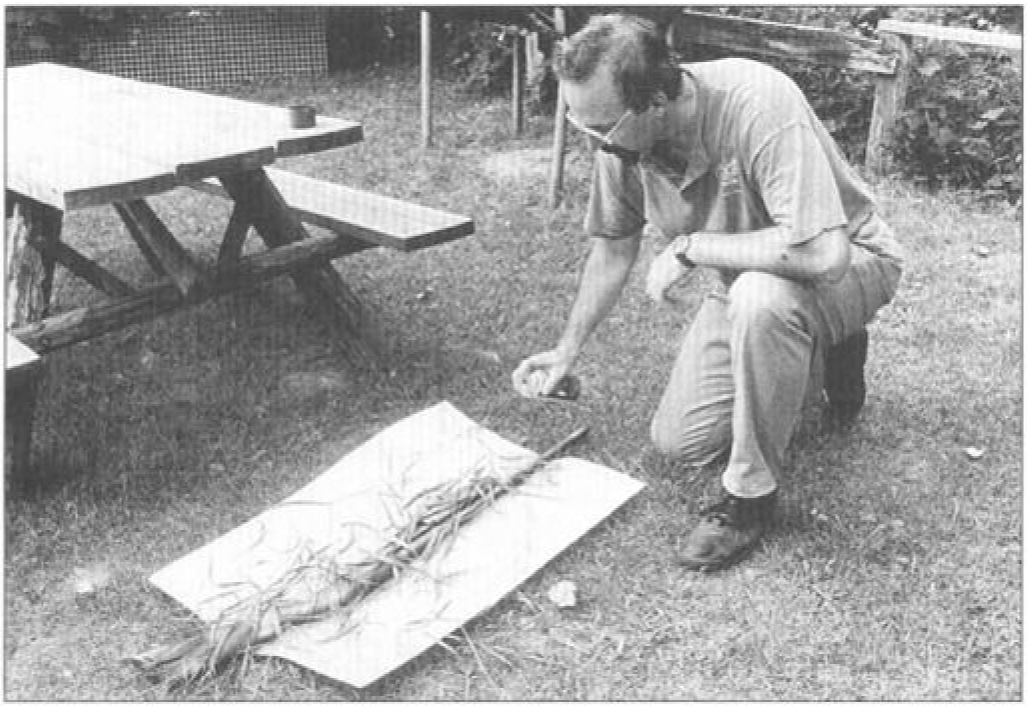
A non-camouflaged shotgun is an obvious non-native object that a turkey can easily see.

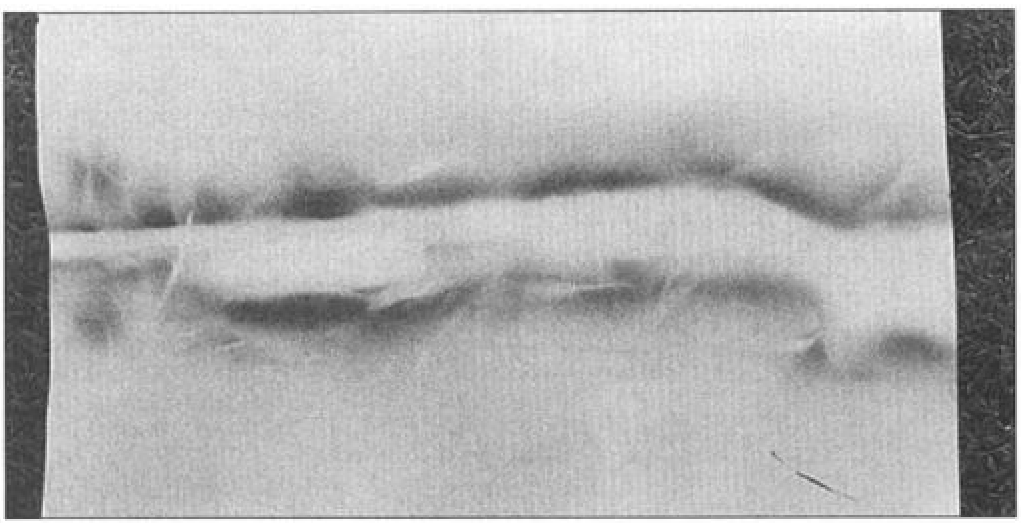
Camo stock and forearm is a good start. With some paint or Camo-skin, the rest should get covered also, and you'd have a turkey gun. (Photo courtesy Remington Arms Co.)



If you don't want to paint your shot gun, then you can use an adhesive-backed camouflage tape.

With a couple of colors of flat paint, and a few leaves from your gun club, you can camouflage your shotgun.





As you can see from the overspray, it doesn't take much to camoflage a shotgun.

Once your season is done, carefully peel the cover off. Clean leftover adhesive residue with cleaning solvent or mineral spirits.

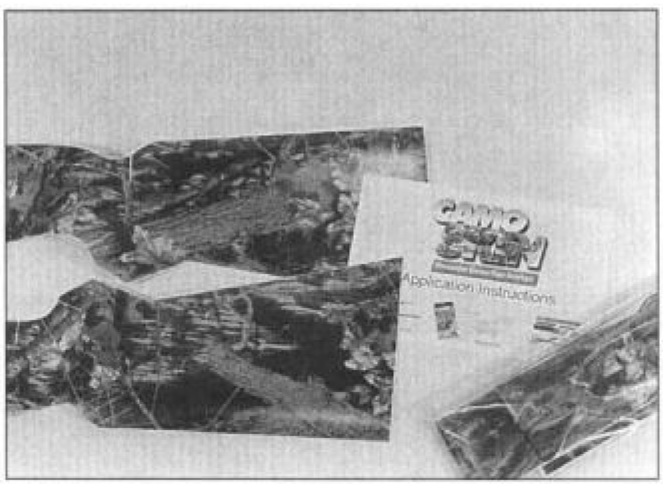
As you can well imagine, launching large payloads at high velocity will mean heavy recoil. Coupled with the typical turkey hunting shooting

posture, sitting with your back to a tree, recoil can hurt.

Porting on a turkey gun is a definite improvement, and a soft recoil pad is almost a must. Turkey hunters have no monopoly on the desire for comfortable shooting, so both are already covered in other chapters.

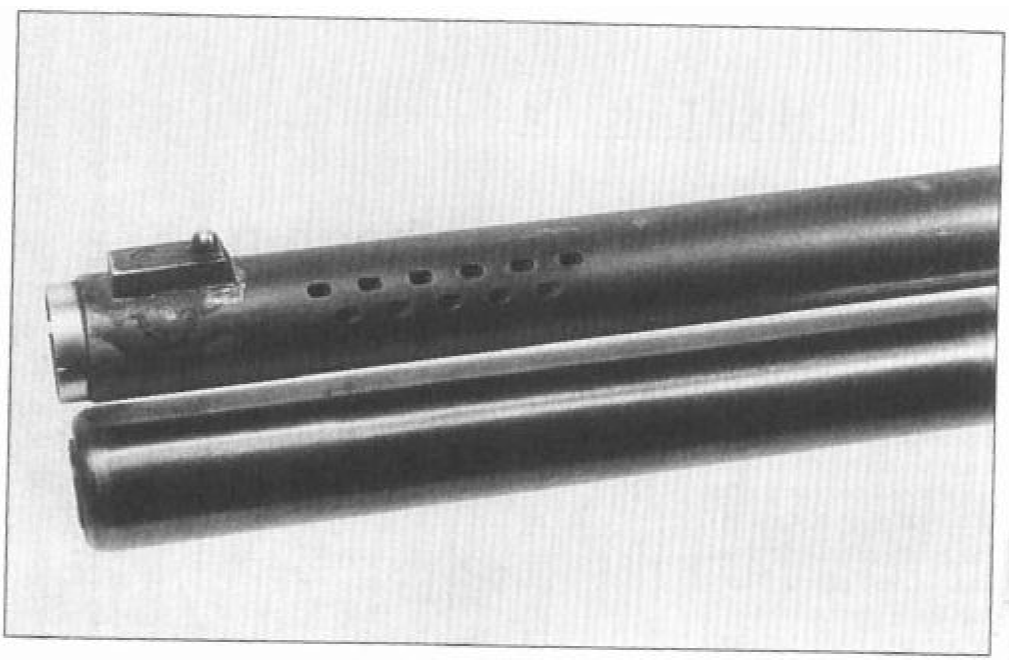
A carrying sling is useful on a turkey gun. You do not still hunt turkeys. (At least most of us don't.) All the walking you will be doing is carrying your gear to your selected blind. Since you'll have food and water, a compass (we hope), and perhaps a stool and section of camo netting and stakes, you'll need some way to carry your gun. The successful hunter will have all that and a turkey on the return trip.

A sling on the gun is handy in carrying it. A sling does not have to be a quick-detach design, but QD's are the most popular and easiest to find. It may seem a bit silly in the gun shop, but pick a camo sling. If anything, anything at all sticks out from the brush, in color or pattern, the turkey will see it.



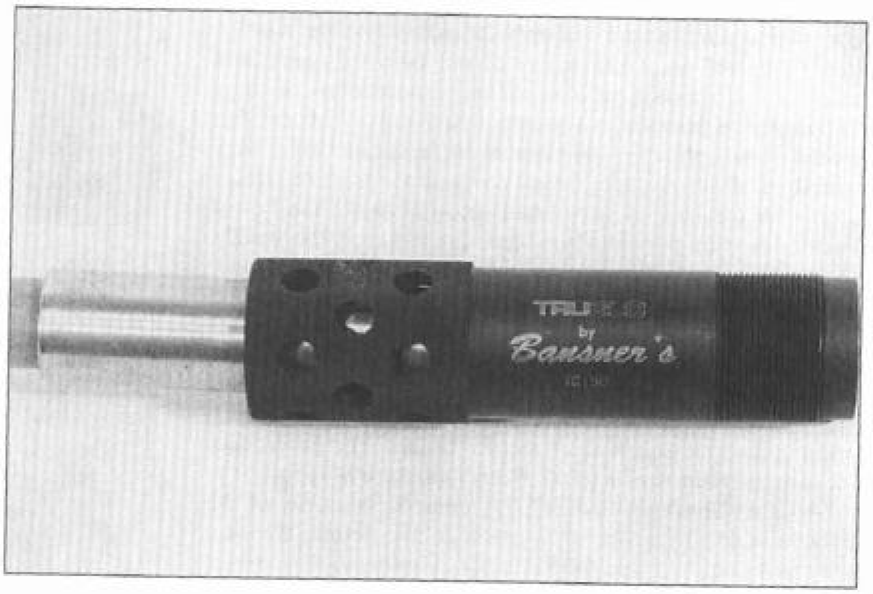
The Camo-Skin kits come pre-shaped and include instructions. Be sure the shotgun is clean and dry before you apply, and you'll get a good bond.

With flat black as a base coat, you can then spray green, brown and tan as your camo pattern.



Turkey loads kick hard. You might want to consider some sort of potting to reduce felt recoil.

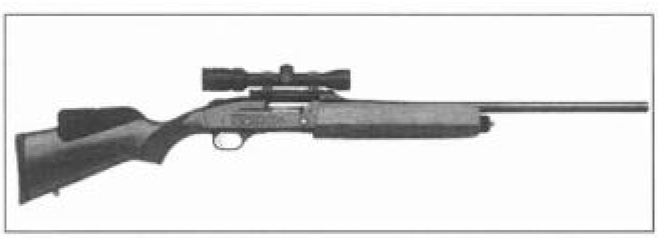
The ports in the Bansner choke from Truglo vent gas to reduce recoil.


by
Bansner's

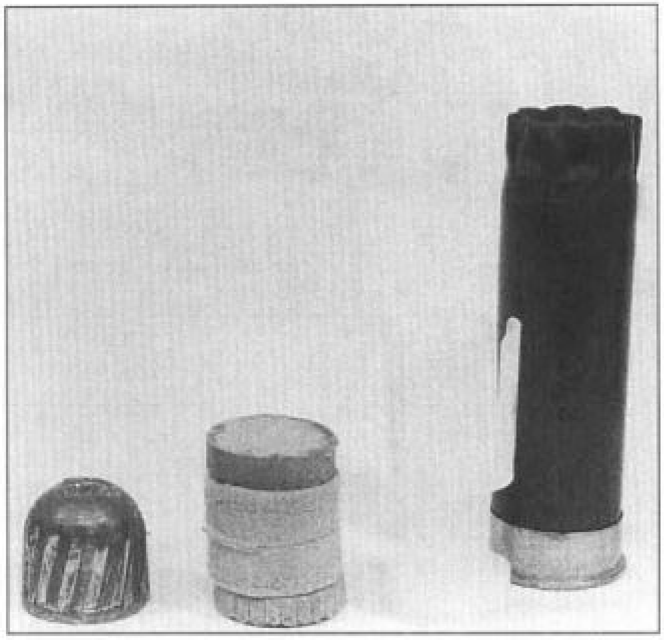
Chapter 19
Building a Deer Hunting Shotgun

Many states have restrictions on the use of rifles in deer hunting. Michigan for example, has the lower half of the lower peninsula restricted to shotguns and handgun hunting only for deer. The idea is that in the relatively populated rural areas, hunters should be using firearms with a limited range. If someone misses a shot at a deer on a ridgeline with a rifle, the bullet may travel a mile or more. With a shotgun the maximum range will be in the hundreds of yards. Sprawl has negated some of the good intentions of this policy. Many retired auto workers have moved “up north” to a quiet cabin in the woods or by the take. There are now areas up north that have population densities greater than the agricultural south. That is not our problem in this chapter.

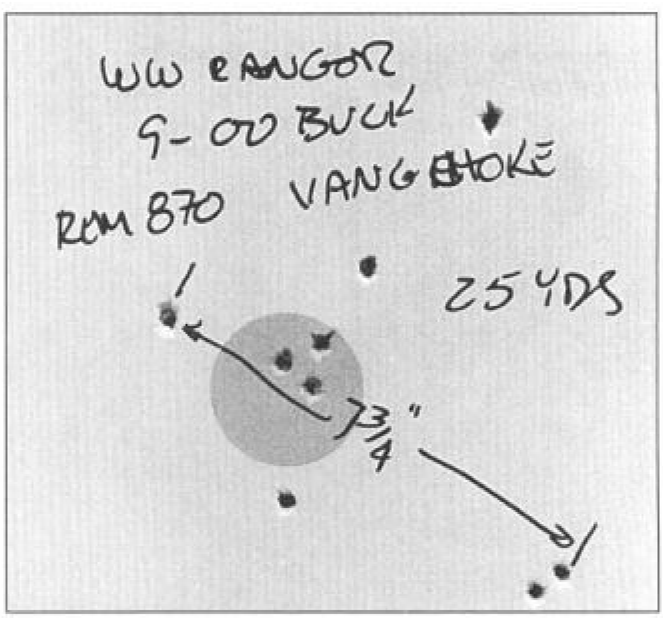
The typical deer gun only a generation ago was a pump or auto with a smooth barrel of only 20 inches that had a set of iron sights on top. I saw many of our club members, and many of their friends, who would only shoot a box of slugs to familiarize themselves with the new barrel. With the gun more or less sighted in and a somewhat accurate barrel, they would go off in search of deer. Why so little practice? Slugs kick. One measure of power and recoil is called the Power Factor. Used by practical handgun shooters, it is the weight of the projectile in grains times the speed in feet per second. The end result is a six-figure number, and everyone drops the last three zeros to make it a little less cumbersome. A handgun chambered in .45 ACP, in order to make “Major” has to have a PF of at least 175. A 230-gram bullet going 760 feet per second makes it. A .44 Magnum handgun, with a 240-grain bullet going 1200 fps has a PF of 288. The Power factor is momentum, and a good relative measure of recoil.



The cantilever scope mount, attached to the barrel, is an efficient way to attach a scope to your slug gun. (photo courtesy O.F. Mossberg & Sons))

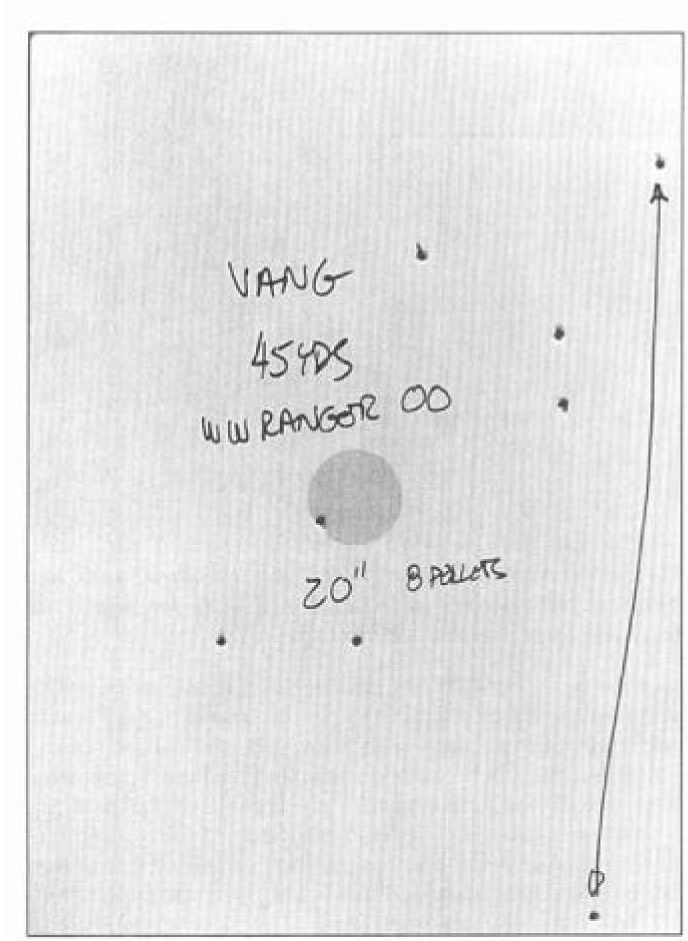


The Foster slug is a lead cup, and the extra space in the hull is taken up with a stack of card and felt wads

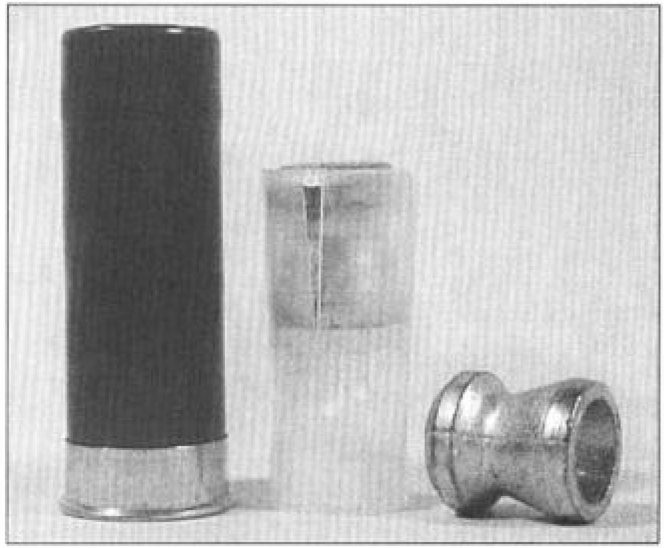


Some favor buckshot for hunting. If you used this load in this barrel, and stayed within 25 yards, maybe.

A light skeet load pushes 1-⅛ ounce of shot out of the muzzle at 1150 fps. At 7000 grains to the pound, the shot weighs 492 grains, and the PF is 566. Almost two .44 Magnums, but that recoil is soaked up in a shotgun that weighs at least three times as much as the .44 Magnum handgun we are comparing it to. A .30–06 only has a PF of 420. When I was developing a slug gun for use in the slug match at Second Chance, it happened that the barrel I was testing liked Winchester 1-ounce slugs the best. It would shoot them into tight 6-inch groups at 100 yards. Petty darned good, and very consistent, for a smooth-bore barrel. But they kicked. Those 1-ounce slugs left the muzzle at 1600 fps, for a PF of 700! An average load for the .375 H&H Magnum would push a 275-grain bullet at 2700 fps, for a PF of 742. Slug guns are close to elephant guns in recoil? You bet.



Forty-five yards isn't that far for deer hunting, and this pattern (one of the best-performing barrels I've seen) is already too open.



***The Lyman slug uses a standard wad as a sabot, and gives the reloader a choice of slug to load for practice or hunting*.**

And that is why many shooters to this day will have only a vague notion of how accurate their slug gun is, and where it hits. It kicks so hard they can't stand to sit at the bench and test it. Slug barrels, even rifled ones, can be very particular about the slugs they shoot. To find the most accurate you have to shoot for groups. The knowledge is worth the effort. John Simon, the Sales Manager at Northwest Gun Shop near Detroit, bought a Mossberg 835 slug gun when they first came out. He wanted a shotgun for deer hunting in the lower half. The rifled bore promised tight groups, and he figured the 3-½-inch chamber would allow him to test every slug load out there in search of the most accurate one. He almost had to. Luckily he purchased the shotgun early in the summer, for every weekend he was out at the range trying one slug load after another. Having worked his way through all the premium slugs then available, including the sabot slugs and the Magnum slugs, he reached deep into his ammo locker and came up with plain old lead Foster style slugs loaded by Remington. Those 1 -ounce lead hollow-base slugs would shoot into a single ragged hole at fifty yards. The two morals of the story are; it is worth the testing (and you get practice, and that is never bad) and you should try the plain, cheap loads first.

To really know how well your shotgun shoots, you have to try it with several brands of slug; all you can get your hands on. And shoot from a rest.

The traditional slug can be reasonably accurate, but sometimes not. The Foster style has changed little since the depression era.

But how to deal with the recoil? Jump to Chapter Twenty One and see if you want to use one of the recoil-reducing options there. Also, plan your

range trip and take the test-firing comfort improvements from Chapter 21 with you.

Building your slug gun, you have several options, and each requires a decision. First, do you upgrade your existing shotgun, or build from a new one? Do you use a smooth-bore barrel or a rifled one? Do you go with iron sights or a scope? And finally, can you reduce the felt recoil by using a smaller gauge?

Last things first. While a 20-gauge slug has less recoil than a twelve does, it also delivers less energy. The decreased energy is simply the cost of reducing recoil. However, as most shooters use 12-gauges, most of the options are available in that size. You will not have as many choices of barrels in 20-gauge as you will in 12. But, you can have your cake and eat it, too. Customers getting kicked hard by slugs complained, and the ammo makers responded. There are now reduced-recoil slugs available in 12-gauge. With the reduced-recoil slugs you can have less recoil and all the choices.

The problem with old bolt-action shotguns is that they have no place to mount a scope without a major hassle. They are also not very accurate even after you put a scope on them. Practice your gunsmithing on one, but don't depend on it for hunting.

Do you need a rifled barrel? Not if you test ammo until you find this performance or better. Don't settle for what's on sale. Test until you find what works.

Lets work our way up the slug gun modifications. The simplest means of upgrading your shotgun is to find a slug load it shoots accurately as-is. However, you should not use slugs in a full choke barrel, so the simplest choice isn't for everyone. If you have a barrel with screw-in chokes than use a skeet or improved cylinder choke, and test fire with different slugs. Assuming you have a shotgun with a barrel that isn't choked full, what kind of accuracy can you expect from it? With only the bead out front, a good combination will deliver 50-yard groups of 5 or 6 inches. Before you exclaim that such groups are useless, remember that much deer hunting is that close or closer. In the cedar swamps, and the brush of last year's logged-off section, 50 yards is a long distance. However, don't be deceived by averages. It is entirely possible that your shotgun responds well to a particular load. Bob Gerak, ex-Vice President of Livingston Gun Club and an avid bowling pin shooter, has a smoothbore barrel for his 1100 that shoots quite well. Shooting offhand it is no problem to keep every shot on a 10-inch plate at 100 yards. He makes sure he keeps plenty of the favorite ammo on his shelves.

If you own a pump or auto with a removable barrel, you can swap out the plain or vent-rib barrel for a smooth or rifled slug barrel. If you are going to buy a new barrel or keep the old one and build up a slug gun, test your barrel! And then improve your accuracy by first improving your sights. If

you have a ribbed barrel you can clamp sights to it to improve your aiming ability.

In the old days the arguments raged around ivory or brass beads in a rifle blade. Now, the arguments are red or green? What color should your fiber optic sights have in them? Before you scoff at the notion of using a green dot in the green forest, consider a few things. The leaves are likely to be off the trees when it comes time to go after your deer. A green dot is quite visible when your background is brown and gray, trees, leaves and mud. Some people have a more difficult time seeing a clean edge on red than other colors. Red can pop out at you, but if you can't focus clearly on the dot because it is red, aiming can be tough.

If you have a plain barrel, improving your sights is going to mean installing rifle-type sights, making it difficult to use the barrel for birds or clay pigeons. Before you turn your plain barrel into a slugs-only barrel, decide if you want to make the leap. What will you do for bird hunting or clay pigeons? If you want to be able to switch back and forth, then buy another barrel for you shotgun. Buy one that has a ventilated rib and screw-in chokes. And test-fire the plain barrel with slugs to see if it delivers acceptable accuracy.

What Is a Shotgun Slug?

Basically a modest improvement over the projectiles used in the Revolutionary War. Shotgun slugs come in four flavors, three of which are the commonly-seen ones today. The oldest is the “punkin ball” a simple lead sphere. Left undersized to fit through any choke, the round ball usually had accuracy that varied from marginal to miserable.

In 1898, Wilhelm Brenneke developed an improved slug. (1898 was a good year for firearms in Germany, the Mauser rifle, the Brenneke slug, work continuing on developing the Luger pistol.…) He took a cylindrical slug and attached a wad to it with a wood screw. The slug showed small improvements in accuracy, and after developing the fins for better bore-centering, accuracy improved. The wad sealed the slug against gas pressure, the ribs eased it's passage through the choke, and the weight-forward design kept it traveling in a reasonably straight line.

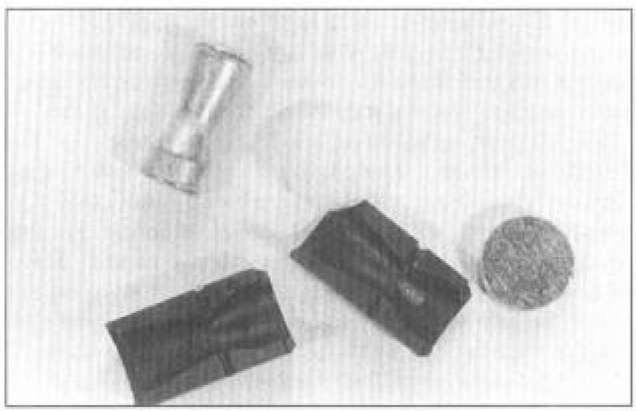
Brenneke slugs cost a lot, then and now. In the 1930s, Karl Foster got tired of the inaccurate round ball, and started work on an improved design. He settled on a hollow-base slug of soft lead. Again, the mass-forward balance (known in ballistic circles as the “rock in a sock” principle) keeps the slug on a straight path. Again, the ribs are meant to ease passage through the choke. The “rifling” on a rifled slug is not meant to cause it to rotate through the air. It is to keep your choke and barrel intact.

The last type is the “sabot” slug. The sabot (French for shoe, after wooden shoes) is a two- or three-piece plastic casing around the slug. The sabot grips the rifling (or not) and keeps the slug from the barrel. When the package leaves the muzzle, the sabot drops away and the slug travels to and through the target. The principle was developed for and by the military, for tank guns. By using a large bore to propel a small-diameter projectile, the gun can develop amazing velocities. The current example is the US M1A1 tank, where the Armor Piercing Fin Stabilized Discarding Sabot (say that fast three times) can be propelled at velocities up to 5400 fps. The exact performance of the “spike” (slang for the projectile) is classified, but the gun is accurate enough to hit another tank a couple of miles away, and put said tank out of action.

Your shotgun will not do nearly as well, but it will certainly do for deer hunting.

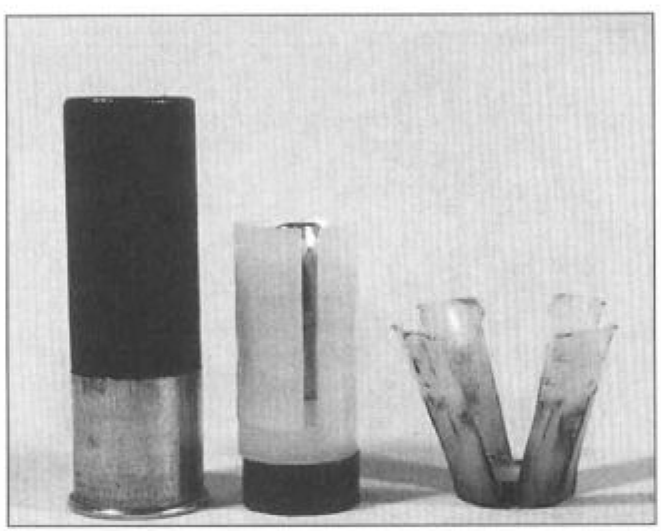
The Brenneke-style slug uses the plastic or felt and plastic wad as a ballistic guide, keeping the slug on track.

Any of these designs will shoot through a deer. (The shotguns, we know the tank will.) Which one you select is determined by one thing, and one thing alone: your shotgun. If your shotgun shoots a slug accurately, then it is on the short list for potential use. If it won't, then the printed ballistics don't mean a thing for you.



The sabot slug is held in a two- or three-part plastic sleeve. The sleeve drops away when it and the slug exit the muzzle.

Slugs come in many sizes and shape. Left to right in the front row; Federal Sabot, Winchester Supreme, Quick Shok, Sellier & Bellot. Center row; Lightfield, Remington Copper Solid, Lyman, Winchester slug. Back row; Remington slug, Federal slug, Federal Low Recoil slug.



Using this Remington Copper Solid sabot, which is hard and not compressible, can damage a full choke. Use this and other sabot rounds only in rifled barrels for best accuracy.

To install iron sights on a plain barrel, you first need the sights. To determine the height of the sight you have to start at the rear. Putting a rear sight on the barrel is not easy. You can't drill and tap, so the only choice is soldering. Putting heat into the barrel that close to the chamber never appealed to me, so I always installed the rear sight on the receiver. Since it was going to be close to the shooting eye, the best sight is a peep sight. Both faster and more accurate than an open sight, installing the aperture or peep sight is a piece of cake.

Even without a scope, a smoothbore slug gun can deliver good accuracy, with the right slug. Which is right? To find out you'll have to test.

First, the sight, I started installing sights by using the Williams Guide sight intended for Remington rifles. The guide sight is smaller and less cumbersome than sights that attach to the side of the receiver. But there is an advantage to a side-mount receiver sight; when you remove the sight arm and leave the base on, you can go back to a regular bird barrel and not have the sight in the way. When I was building a shotgun for dual bird/deer use I would advise the customer to go with the side-mount. When building a

shotgun for defensive/tactical use the Guide sight got the nod. When the Mec-Gar ghost ring sight became available I switched to that, for its greater durability.

***The traditional deer shotgun has long been a smoothbore with rifle sights. While it is still a good choice, there are better ones now available*.**

To install your rear sight you'll need a #31 drill and a 6–48 tap, your dial calipers, and a drill press and vise. With either the Guide or side-mount sight on hand, or the Mec-Gar ghost ring, disassemble your shotgun. For the guide sight, slide the base back and forth on the rear of the receiver until you have the base matching the curve and fully supported. Mark the base location. Take your dial calipers and measure the thickness of the receiver. Divide that number by two, and lock your calipers to the new figure. Run a stripe of layout dye or use a felt tip pen to mark the center of the receiver along the sight base installation. Lay the receiver on a hard flat surface and run the calipers down the center of the receiver. Rest one arm of the rear of the calipers along the surface, and the other along the receiver. A second method of marking the centerline is to use the open jaws of the calipers, locked to the half-width figure. Rest the inside of the jaws on the outside of the receiver and the centerline of the receiver, and mark the centerline that way.

***When mounting iron sights on this Remington, the first thing to do is mount the ghost ring. Once it is in place, then you can determine the needed height of the front sight*.**

Using either method, mark the centerline from both sides of the receiver. If you are spot-on, the two lines will coincide. Any error in math or positioning will show up as two separate lines in the dye.

Place the sight base over the line, and mark the screw hole positions. Centerpunch the locations and clamp your receiver in the drill press vise. Drill the screw holes with a #31 drill and then tap with a 6–48 tap. Deburr. Install the sight base and turn the receiver over. If the screws slick through into the receiver, you'll have to unscrew them and shorten them enough to keep them flush. With the rear sight mounted on the rear of the receiver, the wall thickness of the receiver will be great enough that the screws provided with the sight will not stick through.

Mounting the Mec-Gar ghost ring sight differs only in the screw hole spacing. Once you have its location on the rear of the receiver settled, then mark the screw hole locations along the centerline.

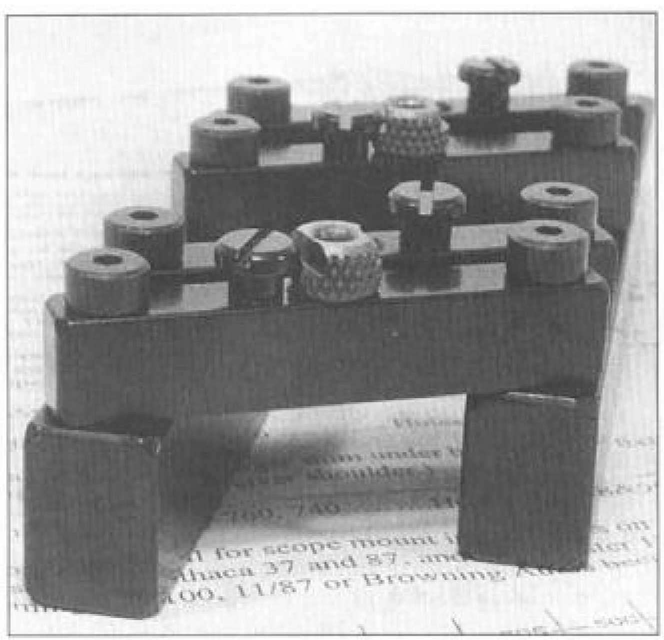
A ghost ring sight can greatly increase your useable accuracy.

After installing the rear sight you'll have to clean the layout dye or ink off the receiver. The simple method is with a brush and a parts cleaning tank. Lacking the tank, bore solvent and 0000 steel wool will scrub the dye or ink off. Once the dye or ink is cleaned off, degrease the receiver and sight base, and the screws, and use a thread-locking compound to secure the screws when you tighten them.

To mount the side-mount sight, you'll need the same parts and some masking tape. Assemble the rear sight and move it back and forth along the rear of the receiver, on the left side. Position it so the sight arm is supported by the top of the receiver where the receiver is level. This location will position the sight a little too far forward for best optical use, but that can't be helped. If you move the sight back closer to your eye, the sight arm will be floating above the receiver and not have any support. Once positioned, tape it in place. With a felt-tip pen reach through the screw holes and mark the side of the receiver. Take the sight base off, and adjust your dial calipers for the height of the receiver from its base to the average of the screw hole locations you marked. Hook the inside of the jaws of the calipers on the bottom of the receiver. Rub the dial calipers on the side of the receiver at the marker locations. Use your centerpunch to mark the drilling spots. Drill and tap the holes, and deburr.

Attach the base and check the screw protrusion on the inside of the receiver. The sidewalls are thinner, and you are more likely to have to shorten the screws. Once the screws are shortened (if need be) then install the sight arm. Adjust the aperture until it is on the centerline of the receiver.

You are now ready to check for front sight height. Reassemble your shotgun and head to the range with the slug load that your testing has proven most accurate. You didn't test? You must, for not only can group size change with different loads, but the center of the various groups can shift. You may find that one slug load shoots a different sized group, and 6 inches higher or lower than another load does. Along with the standard shooting gear, take a roll of masking tape, a felt-tip pen, a pair of scissors and your dial calipers along. At the range, wrap the tape around your muzzle with the ends pointing straight up in a “masking tape mohawk.” Use the fell lip pen to darken the rear of the tape. You now have a temporary front sight. Start close to a large bare hill or back-slop, and test-fire into the dirt. If your slugs hit too low, your sight is too high. Use the scissors to shorten the sight. If your slugs hit too high, your front sight is too short. Add tape to make it taller. Once you are close, sit down at the bench and try your sights on a target; first at 25 then at 50 yards. You can quickly adjust the front sight to the correct height.



***To drill scope mount holes, or a ghost ring installation, the Williams drilling fixture is a great help. With it, you can use a hand-held drill and not need a drill press*.**

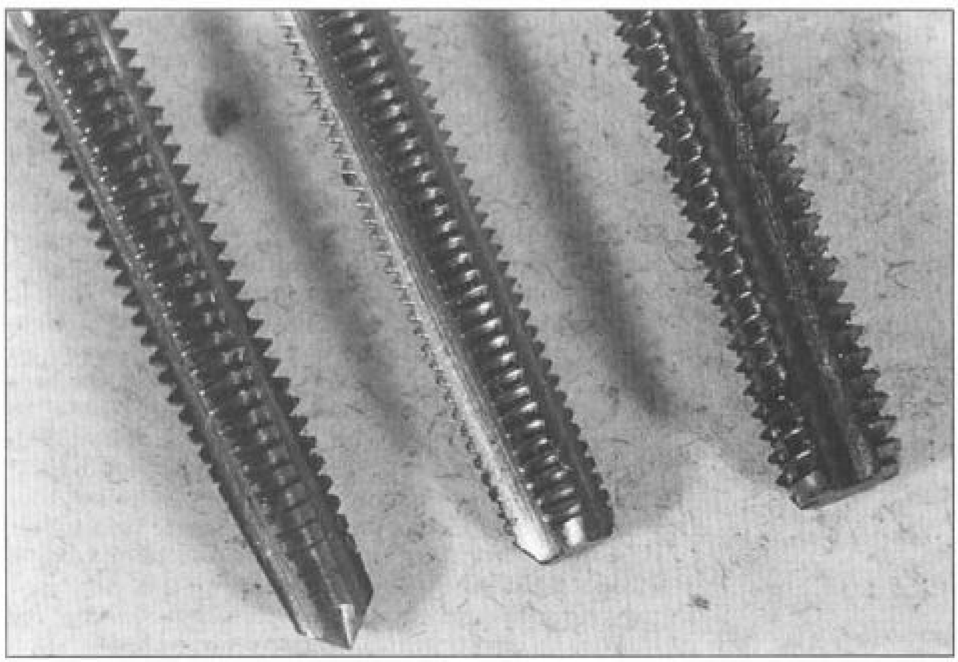
Carefully measure the sight from the bottom of the barrel *to* the top of the sight. Measure the barrel diameter and subtract the diameter from the total. You now know how high your front sight must be. From the Brownells catalog, select a steel sight base and front blade that total or slightly exceed the height you need.

To install the front sight, you'll need the front sight drill fixture from B-Square. Yes, you can do it by eye (with a drill press!) but you can easily get the hole crooked. By using the fixture your holes will be straight and centered. You will need a drill, either drill press or hand-held variable-speed drill. You'll also need half-round files and a barrel polishing hone. Back at your workshop, make sure the shotgun isn't loaded and strip the tape off and position the front sight base on the barrel. Once you have the location set (about half an inch back from the muzzle) mark it with a felt tip pen. Measure back from the front edge of the base to the screw hole and with the felt-tip pen draw a band around the barrel. Slide the B-Square drilling fixture onto the barrel, and position the drill guide on the band you have drawn. Snug the fixture in place, but only enough to keep it from sliding. Slip a drill bit into the drill fixture and shoulder the shotgun. Adjust the drill fixture until the drill bit is vertical as you sight the shotgun. Once positioned, lock the fixture in place.

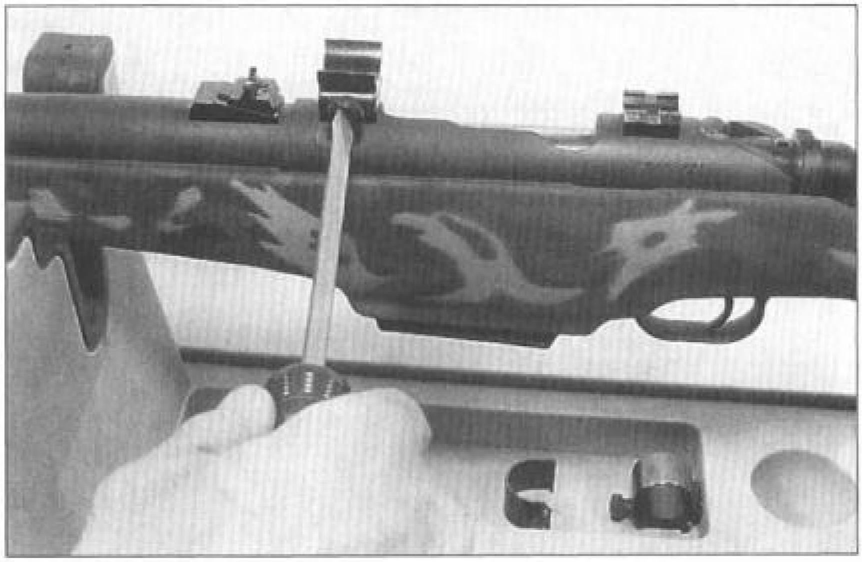
Take the barrel off the shotgun and clamp it in your drill press vise. One advantage to the drilling fixture is that you can drill the hole with a hand-held variable speed drill. This is one of the very few occasions where you can do that. Drill the barrel. If your front sight base uses two screws, then shift the fixture (if needed) and drill the second hole. Remove the fixture and tap the holes. Use a small file to de-burr the edges of the holes on the outside, and tighten the base down. Look into the muzzle and see how much your screws need to be shortened. If they only need a little you can shorten them in place. If they are more than a couple of threads too long, pull them out and shorten them out of the barrel. If you have a very steady hand and lots of practice (I practiced on sections of cut-off barrel that I had around the shop) you can reach in to shorten the screws in place with the sanding drum held in your grinder. However, if you slip, you will mark the interior of your barrel. The slower but safer method is to reach in with the half-found files and file the screw stub until it is flush with the bore. To shorten

the screw out of the barrel, you need a screw holder. The simplest screw holder is a thin bar drilled and tapped to the screw's thread pitch. Tighten the screw into the bar and then shorten the screw on a bench grinder or with a file. Measure the screw before you start, and write down the length you want it to be when finished. Measure your progress.

Once the screws are fitted, pull them out and degrease the screws, barrel and sight base. Use a high-strength thread-locking compound and reinstall the base and screws. Wipe the excess goop off, inside and out. Once it has set, clamp your barrel in a padded vise and use the barrel hone to polish the bore at the screw installations.



Along with drilling there is tapping. The scope mount holes must be tapped, and for that you need taps. Left to right, they are taper, plug and bottom taps.



The Mossberg 695 not only comes already camouflaged, but drilled and tapped and with its own mounts. Bolt the mounts in place and install some Weaver rings.

The only thing left to do is fit the front sight blade. Use a three-sided file with a safe edge to file the sight blade until it will just start into the dovetail. With the B-Square sight pusher, push the blade to the center of the base. Do not use a drift punch and hammer to drift the blade in. The sight is held in place only by the screws, and the drift punch could bend or break them.

If you want a more secure installation, you need to solder the base into place. Once the screws are fitted, use a scribe to mark the outlines of the base. Remove the base and with some abrasive cloth backed by a file, polish the bluing off the barrel inside the scribed line. With a round backer, do the same to the bottom of the sight base. Degrease the base, barrel and screws. Take soldering talc and rub it on the barrel up to the scribed line. If you are using separate solder and flux, apply the flux to the base and tighten the base down to the barrel. Heat the barrel and the base, and once you get the parts up to the melting temperature of the solder, touch the solder to the side of the base away from the flame. The solder will get sucked through the joint, seeking the heat. Once beads of solder appear on the flame side, remove the flame and let the barrel cool.

If you are using Brownells solder paste, apply it to the barrel and tighten the base down. The granules of the solder/flux mixture will keep the base

from fully tightening. Heat the barrel and base, and when you see the solder melt, use a screwdriver to finish lightening the screws.

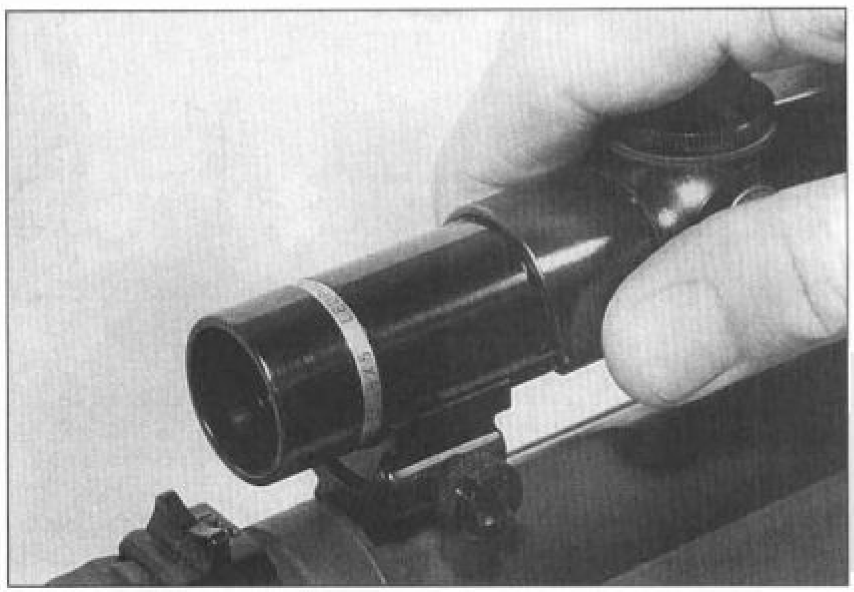
Once cooled, scrub the talc off and clean the excess solder off. If you used a low-temperature solder you won't even have to re-blue your barrel.

With your new slug barrel and the new bird barrel, switching back and forth is relatively easy. Remove the slug barrel and unscrew the rear aperture base screws. Install the bird barrel. When you re-install the slug barrel, screw the ghost ring base back down and go to the range to check your zero. If it is slightly off (it sometimes happens, but usually you are spot-on) adjust your sights and get some practice shooting slugs.

***…and then mount and bore sight a good scope and you're in business*.**

The next thing you can do to improve the accuracy of your present barrel is to use a rifled choke tube. The rifled choke tube is just that, a choke tube with rifling in it. The method is at least a century old, predating screw-in chokes, and was called the Paradox system back then. (Not to be confused with the Hastins “ Paradox” rifled barrels.) The 19th Century Paradox was a shotgun with a short rifled section at the muzzle. The rifling twist had to be slow to keep from disrupting the shot charge, and thus had only a small effect on slugs. But slugs are so short that a slow twist was enough to help. As a compromise then, it worked well. If it worked then, why not now?

First, the improvement in accuracy in the round balls used then was small, not enough to interest today's hunter. In the shell used at the time of the Paradox the shot was unprotected and not held in a cup. Only the pellets on the outside of the payload were deformed by the rifling, and the rest continued on their way as if the rifling had not been present. The rifling in your rifled choke tube will grab the plastic shot cup on modern ammunition and spin it. The whole payload will exit the muzzle with a rotational component, and be spun into a useless pattern only a short distance from the muzzle. Rifled choke tubes are for slugs only!



The Weaver rings use a lip on the bottom that a hook on the top catches and locks in place. Tighten the screws, keep the reticle vertical, and you're off.

The drawback to the excellent option of using a rifled choke tube is that most barrels that have been made with screw-in chokes also had ventilated ribs on them. Installing rifle-type sights on the rib is not easy. In fact, it is hard, since no one makes the needed front sight blade. You will have to make one yourself. The rib is a convenient place to mount the sights, and the sights made are excellent, the Truglo and HiViz sights. But if you want a receiver sight, the vented rib poses a problem.

One method I used to solve the problem was to take a vent rib 1100 barrel that had to be shortened. The muzzle had been accidentally plugged, and

when fired it split. I shortened the barrel back to a rib post, and test-fired it for accuracy with a masking tape Mohawk front sight. It delivered decent groups for a smoothbore, so I used a milling machine to cut a dovetail into the rib at the front post. The sight I had selected was the Clark pistol sight. The dovetail entered the rib from the front. Once the sight had been fitted into the rib I tack-welded it into place. With a Williams Guide sight as a ghost ring I took the 1100 to Gunsite for the basic shotgun class. With it I was easily able to smack the 100-yard pepper poppers.

Using the rifled choke tube without improving the sights will not help your accuracy much. If you can only do one, improve the sights first. But doing both can reap improvements. With a rifled choke tube and improved sights, fifty yard groups down to three or four inches can easily be accomplished.

Scope Mounts

Building a slug gun on a shotgun with a vent rib barrel gives you an option that a plain barrel doesn't, a place to mount the scope. On the barrel.

The simplest and easiest scope mount is to use the Remington cantilever mount. Designed for Remington ribs, the cantilever mount will fit on any vented rib barrel, but works best on the Remington barrels. The rib on a Remington barrel is a single piece of steel. Once the barrel is contoured, the rib is machined to a matching contour on the bottom of its posts. The two are then brazed together. Other shotgun do not have such sturdy ribs. The Mossberg 500, for example, has individual posts that are brazed to the barrel. The rib has a groove on its bottom, and the tops of the posts are notched to fit the groove. If you attach a scope to the rib of a Mossberg, it will have a wobbly perch and could come off during recoil.

The Remington cantilever mount offers several advantages as a scope mounting method. It is removable, so if you want to use a single barrel for everything, you can turn your bird barrel into a scope-sighted slug barrel. When you are done with slugs for the season, take the mount off and store it. When you need to launch slugs again next season, clamp the mount on and re-zero it. Used vented rib barrels are common and inexpensive. If you want to build a dedicated slug barrel, you can easily buy a used barrel and mount a scope to it with the cantilever mount. If the barrel you picked up has screw-in chokes, so much the better. And since the scope is mounted to the barrel, taking the barrel off for cleaning is not going to change your

zero. With a receiver-mounted scope, taking the barrel off for cleaning can sometimes change your zero, and require another trip to the range to check. And the last advantage of the Remington cantilever is that it uses rifle scopes. Or low-power rifle scopes that are called shotgun scopes, the eye relief on a rifle scope is around 3 inches. The cantilever mount gets the scope back over the receiver and in position for your eye. You can choose any of the many rifle scopes available.

The Remington cantilever mount bolts to your rib. First, slide the locking plate under the rib.

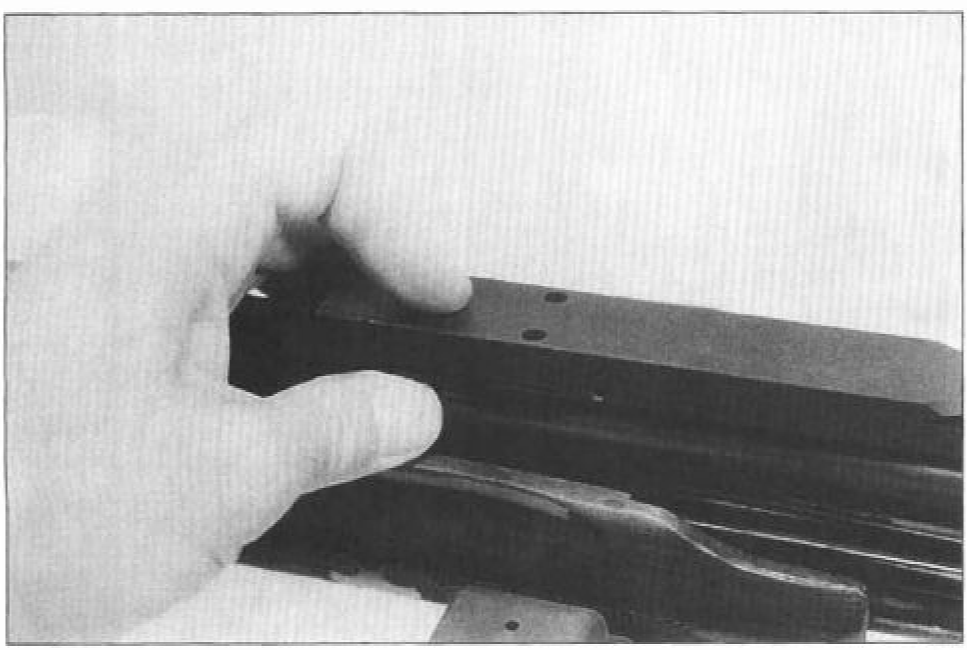
To mount the Remington cantilever is simple. The mount fits over the rib, and has a clamping plate that fits underneath the rib. There are six screws, two set screws on the left side and four clamping screws in from the top. Put your unloaded shotgun into a cleaning cradle for easy access. Start the set screws into the mount. Slide the clamping plate into the third opening forward from the receiver. Place the mount over the clamping plate and loosely install the clamping screws. Press the mount and plate forward against the post of the rib and tighten the set screws. Tighten the clamping plate screws.

With the mount in place, rest your face against the stock in your shooting position, and hold the scope over the mount. Move the scope back and forth until you have the correct eye relief. Rest the scope against the mount, lift your head, and see which cross slots you need your rings in. Take the rings

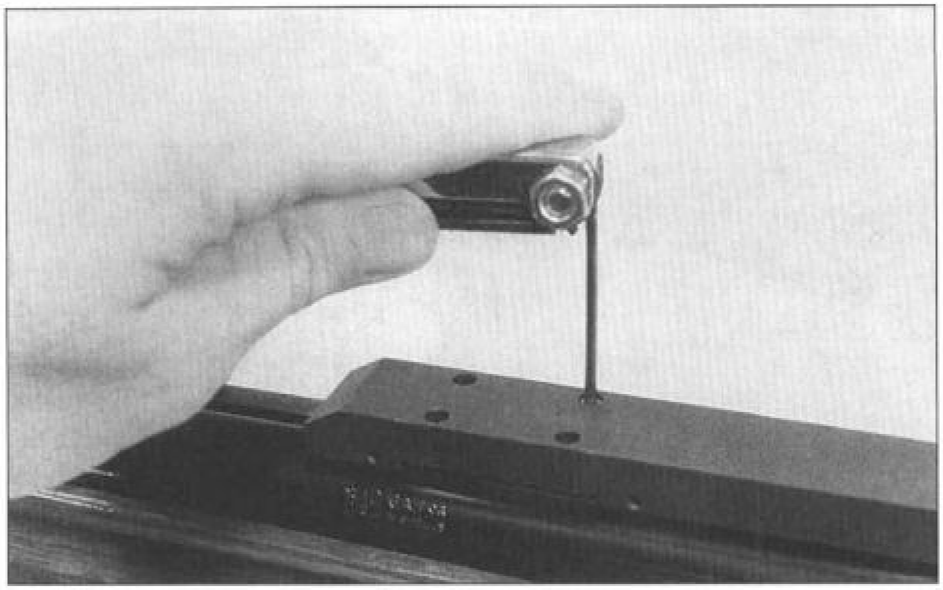
and remove the upper halves, clamp the lower halves in your selected cross slots. Place the scope in the lower halves and put the upper halves in place. Turn the scope until the reticle is level, and tighten the rings.

Once everything is tight, you can use a bore sighter to check the scope alignment. On a rifle the bore collimator can be used to get the point of impact on paper, and quite close to your zero. On a shotgun you may not have as much luck, but you best chances are with a scope mounted on the barrel. At the range, as with your masking tape Mohawk front sight, start at close range, 25 yards or so, on a bare hillside with an assistant spotting your hits.

Not all scope mounts have to reach back over the receiver. If you are using a medium eye relief or extended eye relief scope, or a red-dot scope, there is no need for a long mount. The medium and extended eye relief scopes are designed to rest more than a foot from your sighting eye. The red-dot scopes don't care where they are, provided they are between you and the target. With the popularity of handgun hunting, and the use of red-dot scopes in handgun competition, many more shooters are aware of the front-mounted scope as an option. Rifle shooters are familiar with the front-mounted scope as the scout scope.



Then place the mount over it.

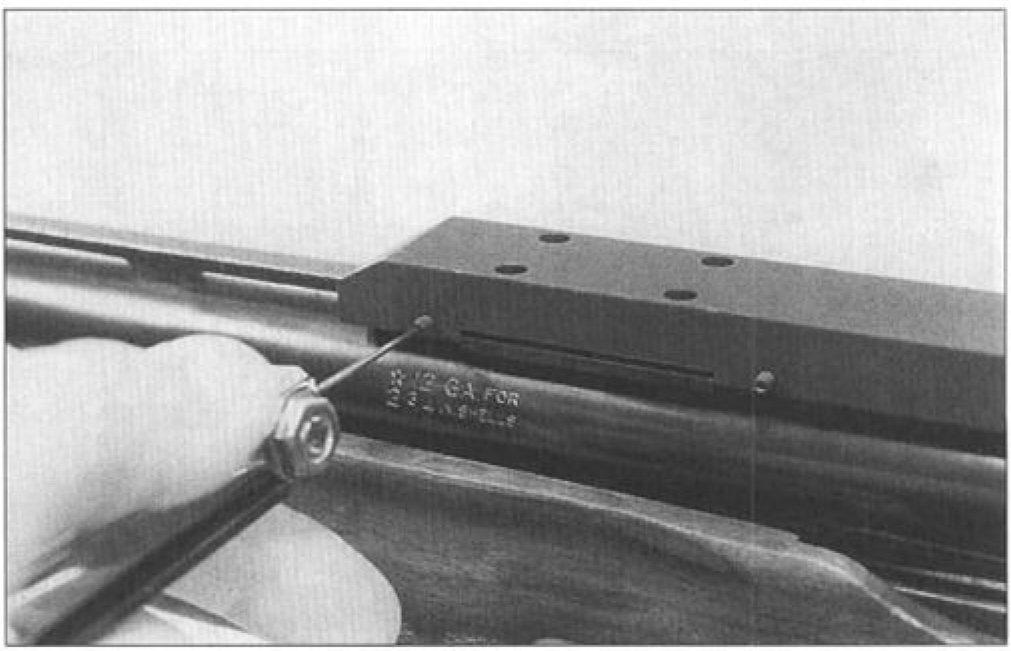


***Then install the mount screws. Leave them a little loose*.**

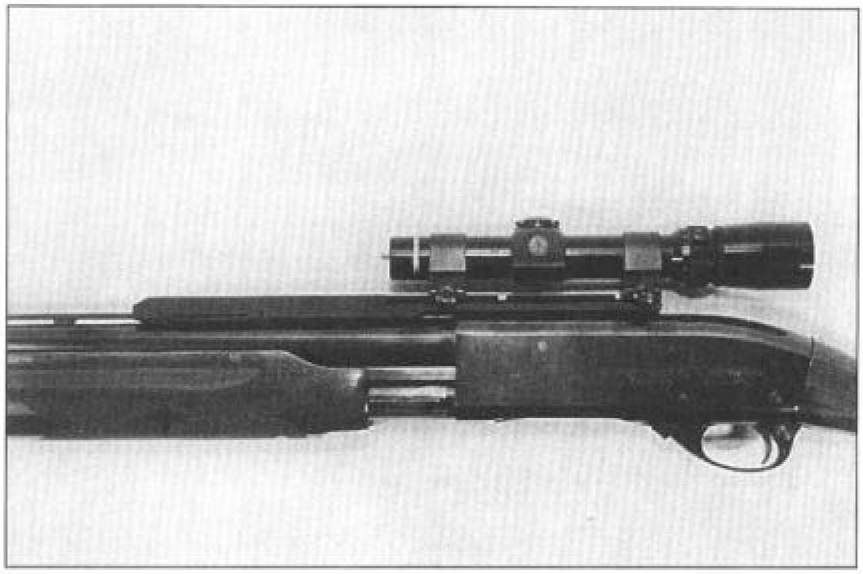
The advantages are many. With the scope mounted out in front, you are less likely to get your attention sucked into the scope, to the exclusion of the rest of the world. Looking through the scope, and only the scope, you may not see that another hunter has just come into view, and might be close to your line of sight. With a front-mounted scope you would see him or her. With the scout scope you would see that the deer next to the one you are aiming at has just lifted its head, and wow what a rack! And the scout scope is fast. Unlike regular scopes, which you aim through and usually close the other eye, with a scout scope you keep both eyes open. With a little practice, your brain learns to sort out what you are seeing. When the shotgun is moving quickly you see the target and background outside the scope. When the reticle settles on a target and the gun slows down, your vision switches to the reticle which has suddenly appeared, and you aim in an instant. And as with the cantilever mount, when you take the barrel off for cleaning you do not lose your zero. Unlike the cantilever, a scope base on the rib is not easily removed. The scout scope is best done on a second barrel and left alone.

Selecting the base is easy. A low, flat Weaver base long enough to fit across two posts is best. The one I selected is intended for a Winchester 100. Take the base and position it on the rib so at least two base screws enter a rib. Mark the hole locations. With a rib center finder, centerpunch the rib on either the front or rear screw hole location. Clamp the barrel in your drill press vise and adjust the travel of the drill press so the drill will not go too deep. On the open spans of the rib, drill through the rib but not into the barrel. On the posts, drill just short of the post-barrel joint. Drill and tap the screw hole. Mount the base to the rib with the single screw, and use the base itself as the locating guide for the front (or rear) screw. Mark its location through the base, then remove the base, centerpunch the rib, drill and tap. Repeat on the two inside holes of the base.

Then tighten the side screws and then finish tightening the mount screws.



The bolt-on cantilever places the scope over the receiver, but is attached to the barrel.



With the rib drilled and tapped, degrease the holes, base and screws and use a thread locking compound to keep the screws tight. As with any scope mounting procedure, install the lower halves of the rings, place the scope in the lower halves and tighten the upper halves in place. Before you lock the scope down, rotate it until the reticle is level.

Another removable scope mount is the saddle mount. Unlike the cantilever mount the saddle mount attaches to and rides over the receiver and uses the trigger mechanism mounting screws or pin holes as the scope base mounting screws. Like the cantilever mount, the saddle mount uses regular scopes, with an eye relief around 3 inches. To install the saddle mount all you'll need is your screwdriver set and some paint or nail polish. On the Remington 870/1100 shotguns, simply press the trigger assembly pins out and store them someplace safe. Slide the saddle mount over the receiver and line the holes up. Early designs of the saddle mount only had the mount clamped on one side. Now the mounts come around both sides, and the mounting bolts tighten the saddle mount around the receiver and not just to it. The mount will come with washers, plastic or rubber, and metal. Put the plastic or rubber ones between the mount and receiver to prevent marking the receiver, and the metal ones between the mount and the mounting bolt heads to keep the steel bolt heads from chewing up the aluminum mount. Press the saddle mount bolt through each of the trigger assembly holes and through the saddle mount.

The saddle mount bolts will be threaded on their ends for a nut or cap screw. Tighten the mounting bolts until the mount is snug. If you tighten the bolts too much you can squeeze the receiver enough to keep the mechanism from functioning properly. If your shotgun worked perfectly before you installed the mount, and now won't feed reliably, you have a too-tight saddle mount. Once you have installed the mount, install the scope. Take the paint or nail polish with you to the range. Once you have fired it enough to know the saddle mount is not too tight, and the shotgun works fine, put a dab of paint on the screw heads and the mount plate. The paint (or nail polish) will both lock the screw in place and act as evidence of movement. You won't have to worry if your scope mount is coming loose if the paint has not been disturbed.

Medium eye relief scopes and red-dot scopes can mount directly to the barrel, in front of the receiver. This Burris scope is very fast and accurate.

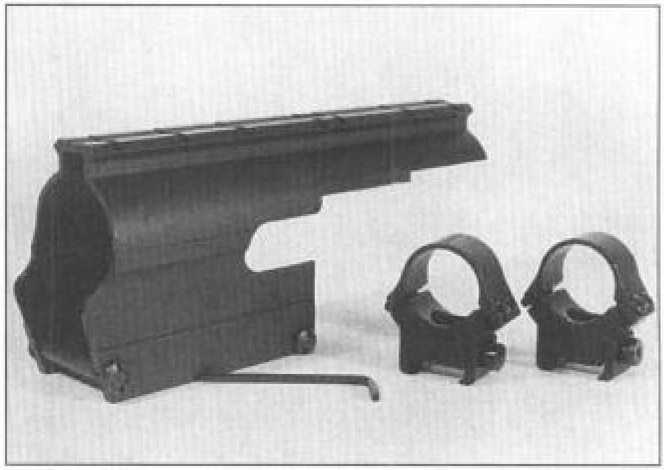
Another way to mount a scope on your shotgun (if it is a Remington) is with this Remington saddle mount. For other shotguns you'll have to get a B-Square or Millett mount.

The last method of mounting a scope is to drill and tap the receiver, or mount the scope on a receiver that is already drilled and tapped. The Mossberg 500 and all its progeny are drilled and tapped, and all you have to do is remove the plug screws, bolt down the scope base and rings, and then tighten a scope into the rings.

If your shotgun is not already drilled and tapped, you can still mount a scope. You'll need a drill press and some means of holding screws for shortening. On Remington shotguns, I used bases designed for the Remington rifles, the 742/760. On Browning A-5s I used mounts intended for the Browning BAR. For Mossbergs that were not already drilled and tapped, the Mossberg mount. In the years before Mossbergs came drilled and tapped, I used the flat base designed for the Winchester 100 rifle.

The Remington mount uses the trigger housing pin holes as the mounting holes for its screws.

In all cases, strip the shotgun. Use layout dye and the dial calipers to mark the centerline of the receiver top. Position the base so it comes to the beginning of the curve of the receiver. You do not want the rear of your base hanging over the curve of the receiver. On the Mossberg you don't want the base back too far, or it will interfere with the function of the safety. You also have a locating problem that you would not have on a rifle. The barrel extension on the shotgun sticks back into the receiver, and the interior of the receiver is milled to accommodate it. The front part of the receiver top is thinner than the rear half. You do not want one of your screw holes to be right on the shoulder of the barrel extension cut. If you try to drill at the shoulder your drill will wander or break. If your drill survives you won't be able to tap the hole. So once you have a preliminary location, compare the hole locations to the barrel step location. You can compare easily by placing a straightedge down the receiver interior and using your thumb as a stop. Then place the straightedge on top of the receiver, again using your thumb as a stop, and see where the shoulder is compared to your marked hole locations. Mark the screw hole positions and center punch the front or rear screw hole location. Drill and lap the screw hole and fasten the base down with the one screw. Use the base to locate and then centerpunch the front screw hole. Remove the base. Drill and tap the front hole and then fasten the base with two screws. Mark the two holes in the middle. Remove the base and drill and tap the middle holes.

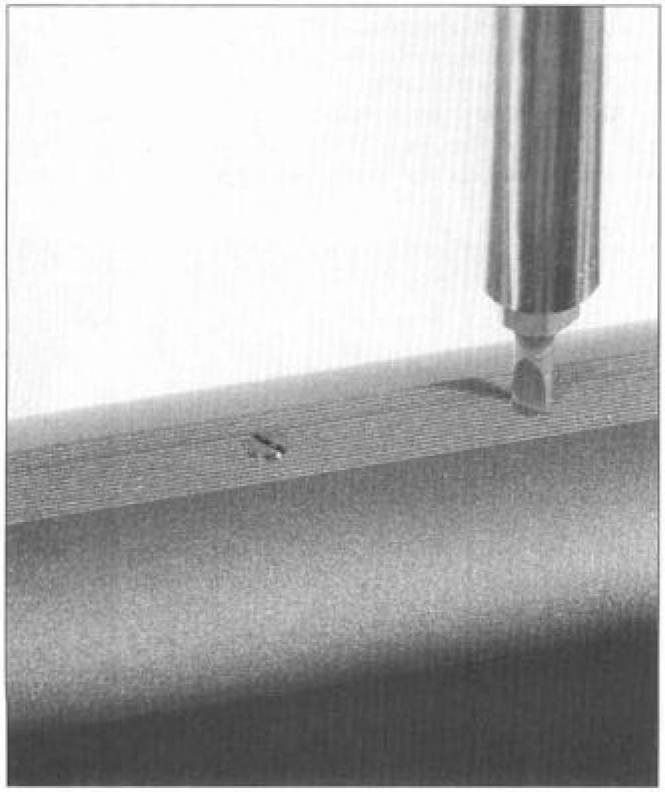


This B-Square mount is intended for a Browning A-5.

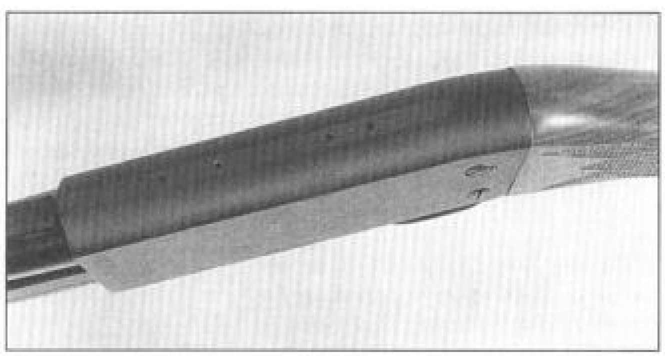
Fasten the base to the receiver and turn it over. The rear screws will probably not stick through into the receiver, as the top wall of the receiver is thick enough there. The thinner section in front probably has screws sticking through it. Through the years, I had more than one customer suggest drilling and tapping right through the barrel extension to tighten the barrel and receiver together. The intention of this approach is to improve accuracy by reducing wobble between the barrel and receiver. It suffers from several limitations. First, the barrel extension is too hard to make drilling and tapping reasonable. Second, the mount screws are too small, and not strong enough for the stress. Third, the amount of extra stiffness the screw might add to the assembly is insignificant compared to the stresses and movement involved.

This Remington has been drilled arid tapped, and has a Weaver base bolted to it.

This Remington Model 11 (a Browning A-5 clone) has a scope mount attached to the receiver. Since the barrel reciprocates, the receiver is the only place for it.

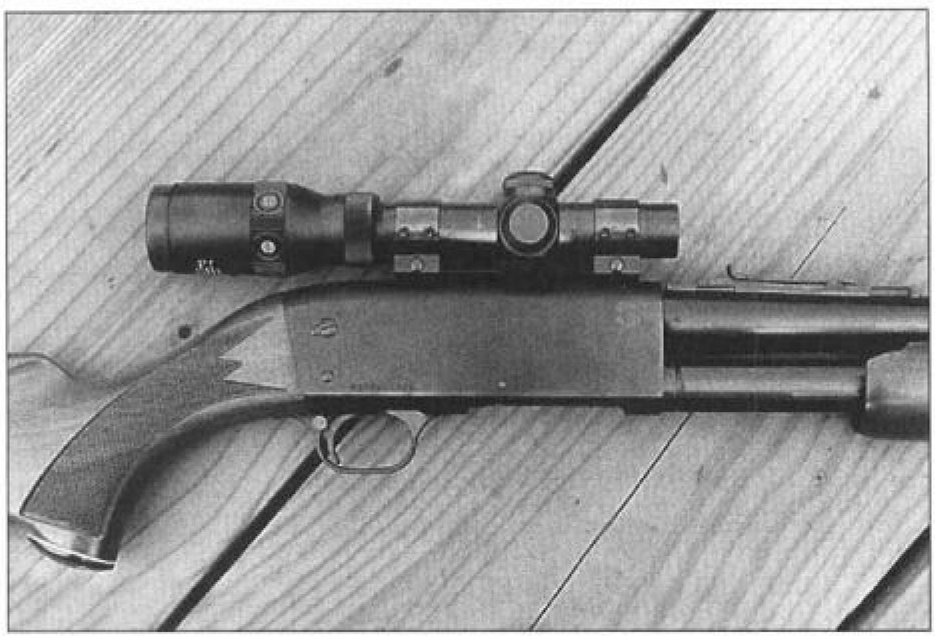


If your shotgun is already drilled and tapped, then you only have to remove the plug screw to start mounting a scope.



This Ithaca is drilled and tapped at the factory, and is ready for a scope base.

The Ithaca with a Weaver scope base.



The Ithaca Slug Special, fully rifled barrel, with a Trijicon 1–3 power scope. A veritable deer-slaying machine.

Count the extra screw threads sticking through. Remove the long screws and shorten them with a file or bench grinder. Once the correct length, reinstall them. With everything set, remove the screws and keep them in their proper order. Degrease the receiver, base and screws, and use a thread-

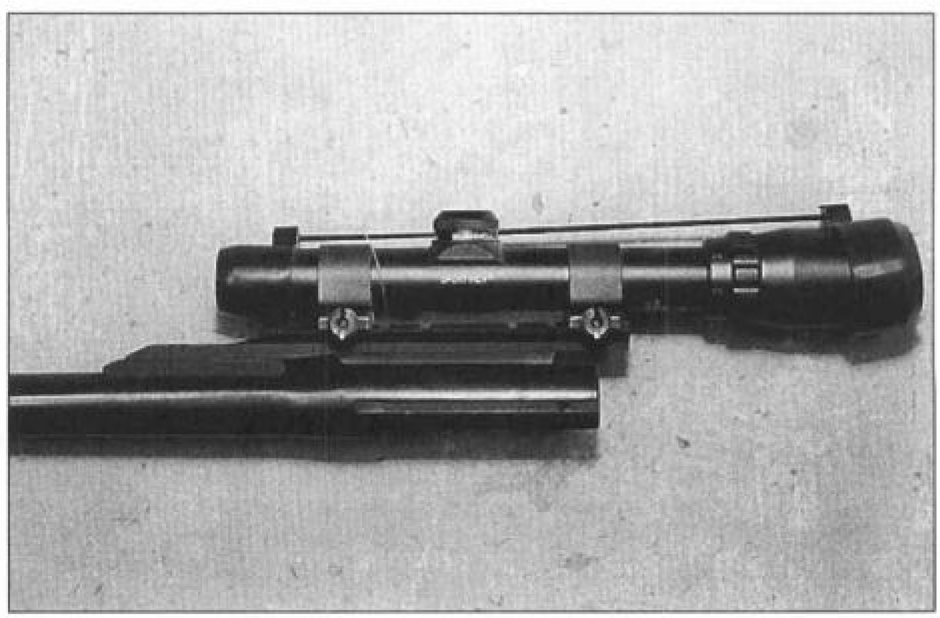
locking compound to secure the screws. Reinstall the base. Mount and bore sight the scope, and use the standard sighting-in method at the range.

Pads and Stocks

The scope on your shotgun is higher above the bore than the beads or iron sights are. To get a proper cheek weld, you need to create a higher cheekpiece. One big advantage to using a Mossberg as the base for your slug gun is their Trophy Slugster dual-comb stock. The stock comes with two cheek-pieces, one the standard height for use with a bead-sight shotgun, and a higher comb for use with a scope-sighted shotgun. It is, however, only available for Mossberg shotguns.

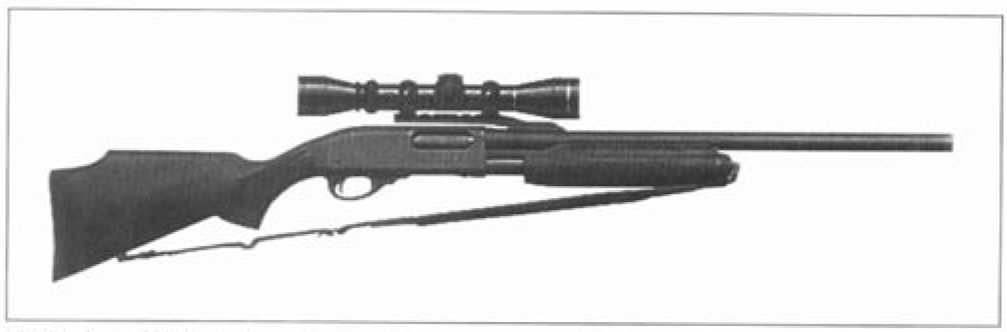
For the other shotguns, you should use the thickest Cheek-eeze or other rubber pad, to raise your face higher off the stock and see the scope.

When the scope is attached to the barrel, you can take the barrel off for cleaning without losing your zero.



Also, only a masochist would build a slug gun and not put a recoil pad on the stock. While there are some who don't notice the recoil, most shooters find it a problem. Ned Christiansen, a serious slug shooter at Second Chance, built a series of pump shotguns for use with slugs, starting with a

Winchester Model 1897 with a steel buttplate. Not until he got to his Browning BPS did he use a recoil pad, and then only because that was the only way Browning shipped them.



This Remington 870 slug gun has a higher comb, to get your eye in line with the cantilever-mounted scope.

Camo Deer Guns

If you feel the need to hide your shotgun from the deer, then any of the methods used on a turkey gun will work. You can start with one already camouflaged, or apply a paint job or stick-on camo.

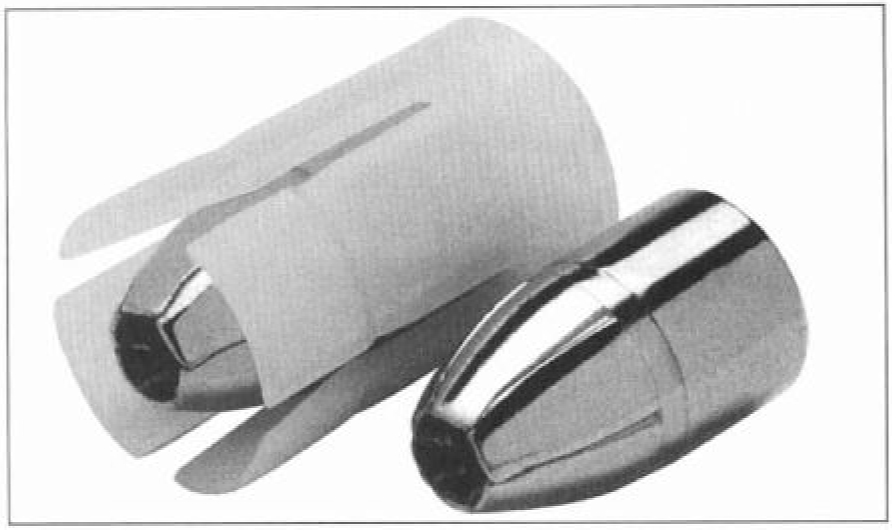
Rifled Bores and Sabot Slugs

The best improvement of all is to replace your old barrel with a new one that has a scope mount attached to it. Obviously, a scope mounted to an A-5 barrel will not work, and there you have to go with a receiver mount. But for the best accuracy you want a rifled bore. An interesting aside: rifles with a bore larger than .50 caliber are considered “destructive devices” by the Bureau of Alcohol, Tobacco and Firearms. A destructive device has the same registration and taxing requirements as a machine gun does. At .72 or .73 caliber, our shotguns obviously are over the limit. When rifled shotguns started to appear, someone with common sense decided that what was meant by “destructive device” obviously did not include shotguns, and so they were interpreted out of the category. I think it was also a matter of self-preservation. Had the ATF held to a strict interpretation of the law, they would have ended up with millions of hunters mad at them, hunters who would not otherwise care about arcane regulations on sinister-looking

machine guns. Those millions of hunters would have pressured their representatives to change the law, and perhaps even punish the officials involved. The taw is the law, but getting your agency de-funded by upholding the law is not smart.

With Remington Copper Solids, the Ithaca slug gun turns in groups under two inches at 50 yards, and that is without practice.

A rifled barrel on a shotgun is the most accurate method to launch slugs. However, even when launched accurately, slugs still suffer from poor aerodynamics. While a slug has better aerodynamics than a brick, it is only marginally better than a baseball. The only way to make the slug better aerodynamically is to make it longer and or narrower. Making a slug longer makes it heavier, and slugs are already heavy enough. One design that makes the slug longer but not heavier is the Brenneke. The cushioning wad that rests **under** the slug on most slugs **is attached** to the slug on the Brenneke design. While it does make the slug longer, the improved shape is probably offset by the rough surface of the felt wad. Some shotguns shoot Brennekes well, others only average.



The Remington Copper Solid is just that, a slug with no lead in it. The sabots peel away once they leave the muzzle, and drop off. Very accurate, and very effective on deer. (Photo courtesy Remington Arms Co.)

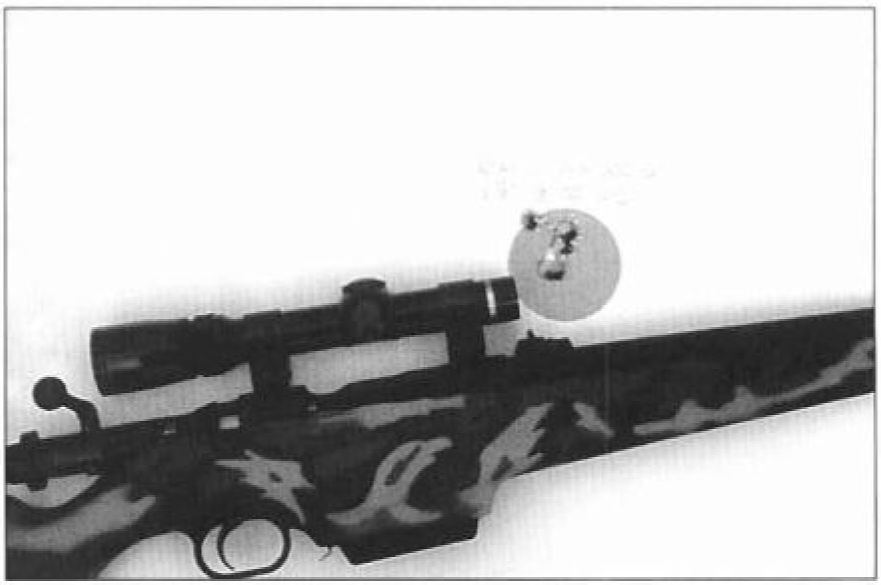
If you make a slug smaller in diameter and longer, keeping the weight the same, it will not fit the bore. You have to use a filler to keep the slug in contact with the bore. That filler is the sabot. While some sabot slugs will shoot decently in a smoothbore barrel, some of them will not. Given that sabot slugs are all more expensive than non-abot slugs, shooting expensive ammo in a smooth barrel and getting the same accuracy you would with cheaper ammo in the smooth bore does not make sense. If you want the accuracy that sabot slugs promise, you have to launch them out of a rifled bore. And what kind of accuracy can you get? It is common to get a barrel/sabot load combination that will shoot a group of 3 or 4 inches… at 100 yards. Some lucky owners have combinations that will do better than that.

The rifled barrel option has several paths you can take. The first is a replacement barrel for your existing shotgun. The scope mount (if you want that 3-inch group at 100 yards, you'd better plan on using a scope) can be either a cantilever or a scout mount. The drawback to a replacement barrel with a scope, as we discussed in Chapter Five on stocks, is the low comb. Realizing the situation, manufacturers make dedicated slug guns with rifled bores. In the case of Ithaca, the barrel is not a replaceable barrel, but screwed into the receiver as a rifle barrel would be.

The last minor variable has been removed. Instead of a barrel that wobbles slightly, the Ithaca barrel on this slug gun is firmly screwed into the receiver. With a scope, and the proper slugs, this shotgun can shoot like an accurate rifle.

Now its just a matter of being patient until Opening Day.

For accurate shooting, riflemen have used bolt-action rifles for a long time. Shotguns can be accurate bolt-guns too. This Mossberg 695 shoots better than some rifles I have fired. No deer hunter could complain about this performance.



If you practice or test a lot at the range, clean the bore regularly. Plastic and lead can quickly build up, adversely effecting accuracy.

In this kind of hunting terrain, an accurate slug gun gives up nothing to a rifle.

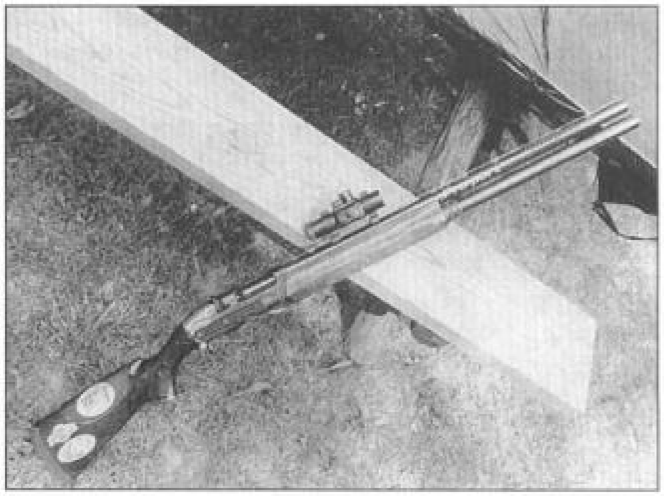
Chapter 20
Building a Shotgun for Practical Competition

In practical shotgun shooting, the targets don't move (thank goodness) until they are hit. Then they fall over.

“What do you mean I missed? It's only 15 yards away!” I heard this mournful cry for the first time more than 20 years ago, and almost every year I hear a variation of it again.

Practical shotgun competition differs from the traditional clay bird games in three ways: the targets, the shooter's position and the ammo. Instead of the usual clay disks, practical shotgun competition uses falling steel plates or paper targets. While the shooter is stationary in the clay bird shoots, in PSC he (or she) has to move from shooting station to shooting station against the clock. PSC shooters often use a skeet or trap load (sometimes

loaded with heavier shot) in some matches there may be a stage that requires the use of buck-shot or slugs.



For those who can become accustomed to them, red-dot sights offer many advantages.

Some matches call for slug shooting. Here, Jerry Michulek is quickly knocking over the steel plates at Second Chance. A red-dot sight is a definite advantage.

The first thing that comes to mind when new shooters see a PSC match is "combat shooting." That may be its genesis, but many of the shotguns used by the competitors bear as much resemblance to a combat shotgun as a race

car does to a Humvee. Our club has had PSC and bowling pin matches for 20 years now, and I am always puzzled as to why more shooters don't get into it. To get started with a reasonably competitive handgun in practical handgun shooting takes more money than a shotgun. Currently, you can hardly get started with durable gear and a handgun for under $1,000. If you want to be competitive, even buying used high-tech gear (handgun, magazines, holster, reloading setup) can't be had for less than $2,000. Compared to other sports, that is cheap. Snowboards can run $500 each, surfboards much more. A blown engine on a dirt bike can set you back as much as a new gun.

In a practical shotgun match, the shoot-off is not only against the guy next to you, but at the same time. Whoever knocks down their targets first, wins.

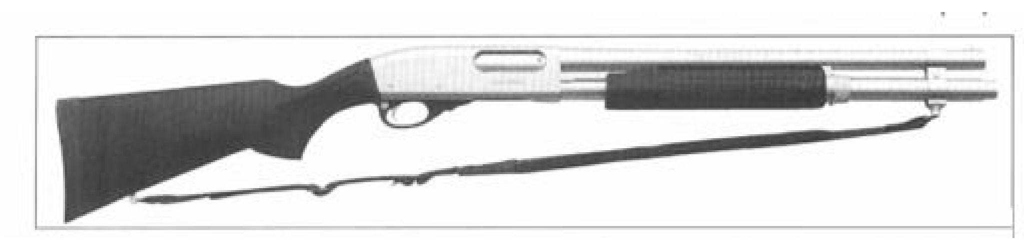
You can have a state of the art PSC shotgun and all the gadgets for less than a grand. Much less if you do the work yourself. So why don't more shooters do it? Beats me.

The first question you have to ask when starting out is: pump or auto. The answer is easy. If you are going to compete in the overall, you need an auto. If you are going to compete in the pump category (if there is one) or in both, then you either need a pump or both. Which model is also easy, at least in the auto. The choice comes down to either a Benelli or a

Remington. The Benelli shotgun is a perfect example of the “love it or hate it” principle. Those who love it extol its reliable function and it fast cycle time. Those who hate it cite its sharp recoil and higher cost.

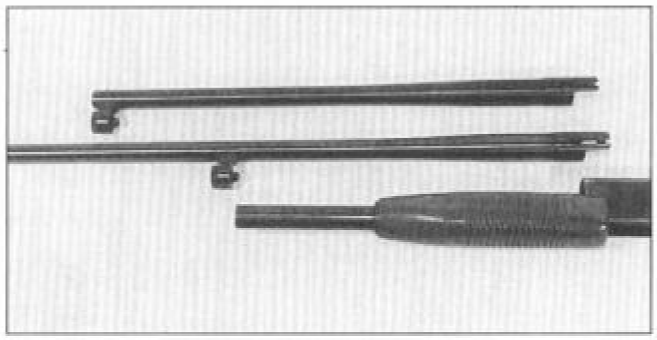
I favor the Remington. Not only is it cheaper to obtain and more common, but parts and accessories for it are more common. And I don't like the recoil of the Benelli.

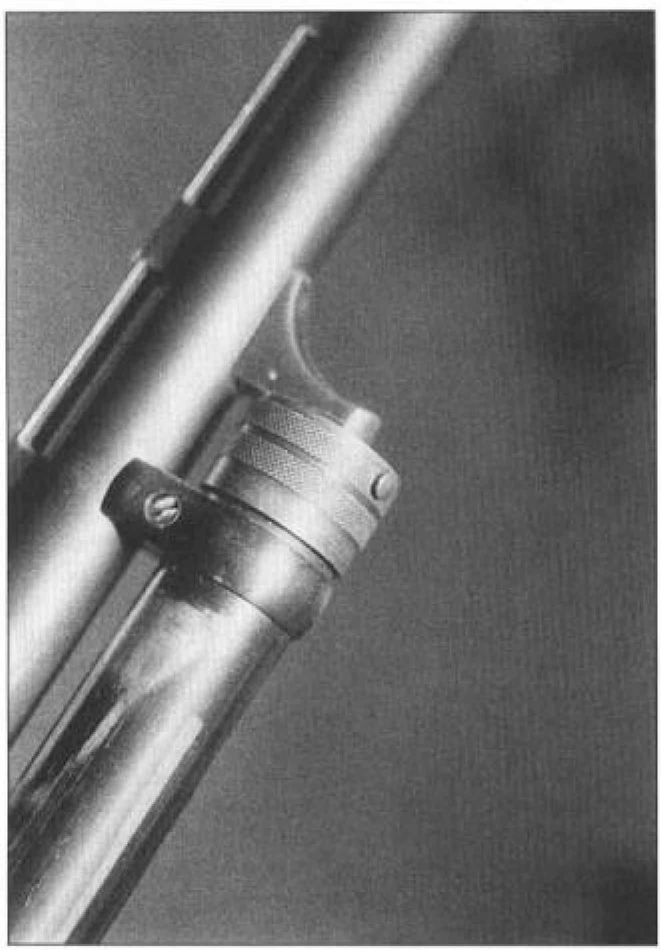
In pumps, the choices are a little wider. The most common pump is the Remington 870. Suitable alternatives are the Mossberg 500 and 590, the Ithaca Model 37 and the Winchester 1300. One drawback to the Mossberg 500 and the Ithaca Model 37 is the need to obtain them in the eight-shot version to start with. If you have an old Mossberg 500 as a spare, do not despair. You can send it back to Mossberg, and for a nominal fee they will swap the five-shot magazine and barrel for an eight-shot magazine and barrel. They will do this for double action bar models only, not the older (pre 1970 production) models. You can do the swap yourself if you have the parts, but the cost could be too much. The barrel fastening design of the Mossberg 500 and Ithaca M-37 precludes the use of a magazine extension tube. Unfortunately for owners of the Ithaca, you can't replace the magazine tube. It is brazed into the receiver and can be replaced only at the factory. Ithaca is not now making for civilian sale any eight-shot M-37s, which is a shame. For those who can learn to deal with the lack of a disconnector, the Ithaca is the fastest and smoothest pumping shotgun around. The Mossberg 590 comes out of the box with a nine-shot capacity. The standard models of the Remington 870 and the Winchester 1300 are only five-shot capacity, and you'll have to fit a magazine extension tube to increase their capacity.



For hard use, it is tough to improve on stainless steel. If you can get past the flashy look (some like it) this 870 will keep on working long after blued steel guns would have quit. (photo courtesy Remington Arms Co.)

Because the Mossberg barrel attaches to the end of the magazine tube, you can't extend the magazine tube. But Mossberg will switch your gun to an eight-shot by replacing the tube and barrel.





The Ithaca barrel also attaches to the end of the magazine tube. To increase magazine capacity you have to buy a different Ithaca.

One small detail about increasing the magazine capacity of your shotgun: On Sept 13, 1994, the Crime Bill was signed into law. Part of the Jaw concerns itself with “assault weapons” A shotgun is considered an assault weapon if it was made on or after Sept 1. 1994 and has two of the following:

(i) a folding or telescoping stock;

(ii) a pistol grip that protrudes conspicuously beneath the action of the weapon;

(iii) a fixed magazine capacity in excess of 5 rounds; and

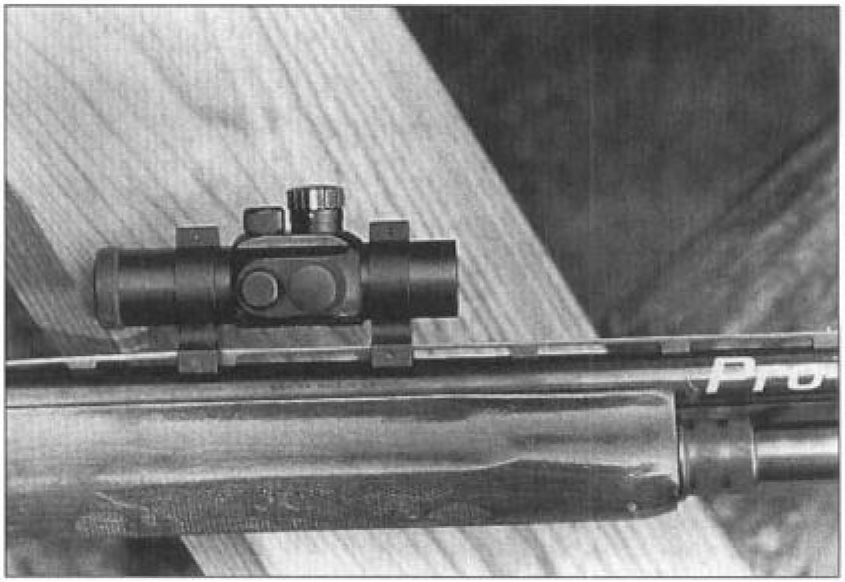
(iv) an ability to accept a detachable magazine.

So, you can have any one of them on a shotgun made after the date, or more on a shotgun made before the date. If the shotgun was manufactured before the law was signed, it is a grandfathered shotgun. If you are worried about the date your shotgun was made, you can write to the manufacturer and they can tell you if it is a “pre-ban”or a “post-ban” shotgun. Curiously enough, the legislators and bureaucrats who are looking out for our safety feel that while a bayonet lug or flash-hider is evil on a rifle, they have no effect on a shotgun. If you want to install a bayonet lug or flash-hider on your shotgun, the law is strangely silent.

Matters of pump and auto settled, the next question is iron sights or optics. The answer depends on the match you enter. Most matches will be Open, that is, no restrictions. If you shoot Open, then you probably should have optics. It is very tough to use irons and beat optics, but it can be done. Some matches will have a Limited or Stock category, which doesn't allow optics, or simply preclude their use.

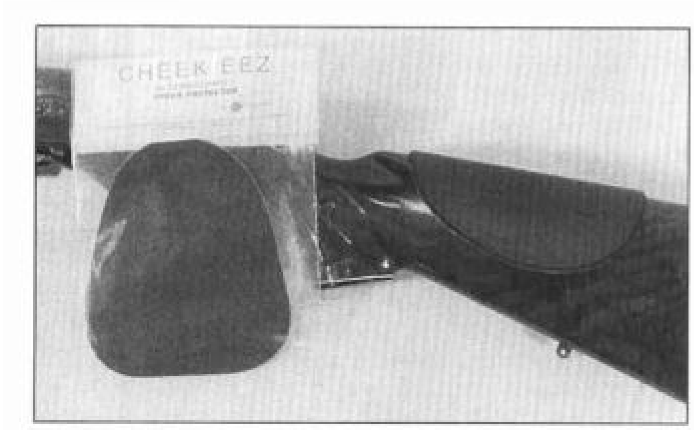
We will build up two shotguns, one an Open gun on an auto, and the other a Stock or Limited on a pump. Both guns will be Remingtons, but the same steps would apply to other choices.

If you are going to shoot in Open class, and be competitive, you'll probably need a red-dot sight.



The Open Gun

The base I'm using for the demo Open gun is a Remington 1100. Remington has made a lot of them, and you can find one almost everywhere. Starting at the stock, install a soft recoil pad. While many shooters like and use the regular waffle pattern, I have found that the Pachmayr Decelerator pads are softer. Another good choice is the KickEeze pad, made of Sorbothane. The neatest setup is the Pachmayr Sporting Clays Decelerator. The SC pad has a hard plastic horseshoe at the top, rounded and smooth. In Sporting Clays you start with the gun down and have to mount it. The smooth plastic top of the pad will slide over your shirt, vest or jacket and not get hung up. In practical competition, you will often have to mount the shotgun to start a stage. Even if you start with it shouldered, you'll have to mount after your reload.



***A steady diet of slugs, buckshot and birdshot calls for a soft cheekpiece*.**

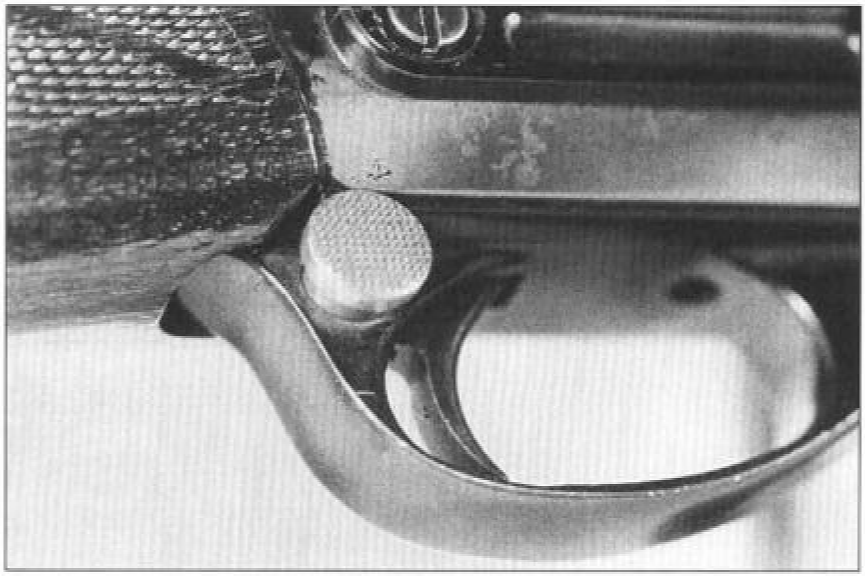
To install the recoil pad, use the standard procedure described in Chapter Five, shortening the stock if necessary.

On the trigger housing we don't need to adjust the trigger pull, but the small safety can be a problem. Unlike clay bird games, you'll have to start each run of PSC with the safety on. Missing the safety is not good for your time or score. You will either need a replacement safety, or a lathe and torch to add to your existing safety. To change safety buttons on the 1100, press out the trigger assembly housing pins and pull the trigger assembly out. Press the safety off and place your thumb in front of the hammer. Press the trigger and ease the hammer forward. In the rear of the housing, the assembly pin hole has a tube running through it. The tube has a clip on one end. Press the tube out of the housing from the non-clipped end. Behind the Large hole is a small one, the safety spring retaining pin hole. Press the pin out and let the safety spring and ball fall out onto the table. The ball may be reluctant to come out. If you leave it in, be sure you don't lose track of it while manipulating the housing.

If you're going to install a large head on your safety, you'll need torches, propane or acetylene. Always have a fire extinguisher handy.

You now have moved the parts that keep the safety in place. If you are replacing the safety, pull the old one out and slide the new one in place. If you are building up the old one, you need some round bar stock. Cut a piece off the bar and use your lathe to turn the end square and flat. Place the old safety in your lathe and cut the top of it flat. The safety is very hard and you should take small passes. Only cut the surface enough to make flats for the new button to rest on and be soldered to. Measure the overall length of the safety bar. With a flat and fresh surface, place the safety in your vise and degrease it. Squeeze a layer of Brownells 80PA high-temperature solder onto the safely, and press your button of rod stock onto the safety. Heat the button to 1,125 degrees, and let the heat run into the safety. Inspect the joint and make sure the vise is not soaking off enough heat to prevent a good bond from forming. (With all this lathe turning and soldering, you can see why people like Scattergun Technologies, now Wilson Combat, make new safeties.)

This is the soldered, turned and checkered safety. Considering the labor and need for a lathe, installing an aftermarket safety is a better choice.



Let the parts cool. Back in the lathe again, turn the safety button down in diameter. I custom-fit each of my Remington safeties and the buttons vary from .440″ to .480″ in diameter. To be sure yours will fit, turn it down to .440″ Turn the end square and .200″ to .210″ longer than the original over all length. To make the button a little more comfortable to your trigger finger, bevel the edges of it in the lathe. Either turn the cutting tool to an angle, or use a lathe file to break the comer. If you have a checkering file you can checker the new safety button before re-installing it. Check the rear of the button where it joins the original safety and make sure you have cleaned all the solder and flux away from the joint and the back of the button. Build-up in this area can prevent the safety from moving far enough to allow proper trigger movement.

To re-install the safety, press the safety and its new button into the assembly housing. Drop the safety ball down its hole and press the click spring in behind it. To compress the spring enough to insert the retaining pin, use a small screwdriver to press the spring down. Once you can start the retaining pin, ease the screwdriver up while pressing the pin across. Once you have most of the spring retained, you'll have one loop of it pinned too high. Use a smaller screwdriver to press the loop down under the retaining pin, working from the side of the pin inside the spring hole. With the safety assembled, click the button back and forth to make sure it is snapping to each setting.

On the top of the trigger assembly, when you removed the rear tube the sear spring relaxed. Make sure the spring is still there. They can sometimes fall out during all this manipulating, and will be lying on the bench. To insert the rear assembly tube, you have to press the sear seat forward, compressing the spring. Start the tube from the recessed side, and press it until it touches the sear seat. Push the sear seat forward enough to clear the tube and finish pressing the tube into place. Cock the hammer. You are now ready to do your trigger assembly function test.

Press the safety to safe. Pull the trigger. The hammer stays cocked. Release the trigger and press the safety to fire. Brace your other thumb against the hammer and pull the trigger. If the hammer does not release, the safety probably has residual solder on the rear of the button keeping it from going fully to the fire position. The caich-22 here is that if the safety won't move, you can't lower the hammer to disassemble the mechanism. Fear not. Use a punch or small screwdriver to press the sear away from the hammer and ease the hammer down.

Assuming your trigger pull released the hammer, keep the trigger pressed to the rear as you allow the hammer to go forward. Once the hammer has gone fully forward, re-cock it. Ease the trigger forward until the mechanism has reset. If the safety was binding, clean the rear of the safety button, reassemble and check function again.

Our demo gun has a 3-inch lifter, so installing one is not necessary. If it had not had one, it would get one. Directions for 3-inch lifter installation and adjustment were covered in Chapter Sixteen.

The arms of the magazine bracket stick down on either side of the loading port. Note the oversized Choate operating handle. This is very useful at times.

Here is the USA magazine guide on a heavily-used Remington 1100.

As part of PSC, a course of fire may have more targets in it than the magazine capacity of your shotgun. (Unless the course designer deliberately

limited each string to five rounds to even things out for the shotguns that have not been “extended”, in which case reloads won't matter.) Even with eight or 10 rounds in the gun, on a 12-target course you'll have to reload. The time needed to reload is begrudged by all shooters, enough for some of them to go to extreme lengths. Some have gone with extra-long magazine tubes. Some competitors in our area have made up 12-shot tubes. One even fabricated a 17-shot magazine tube for his Winchester Super-X 1. He happened to show up with it at our monthly 3-gun match, which had a 17-shot shotgun stage. Needless to say, he won the shotgun stage that day.

The spare loading tubes are carried on the belt.

For those of us with eight- or 10-shot tubes, reloading is a necessary skill. To make the chore faster, USA makes a reloading tube and bracket. The bracket replaces the trigger assembly pins and provides a place to brace the reloading tube against. The tube presses the lifter button and unlocks the lifter, allowing reloading. The process is simple. When you need to reload, turn the shotgun over. Grasp a reloading tube and pull it out of your pocket or belt holder. Place the front of the tube against the guide tabs. Press the tube's follower forward, running four more rounds into the magazine. Some shooters want more, and the only glitch in the USA system is the lifter

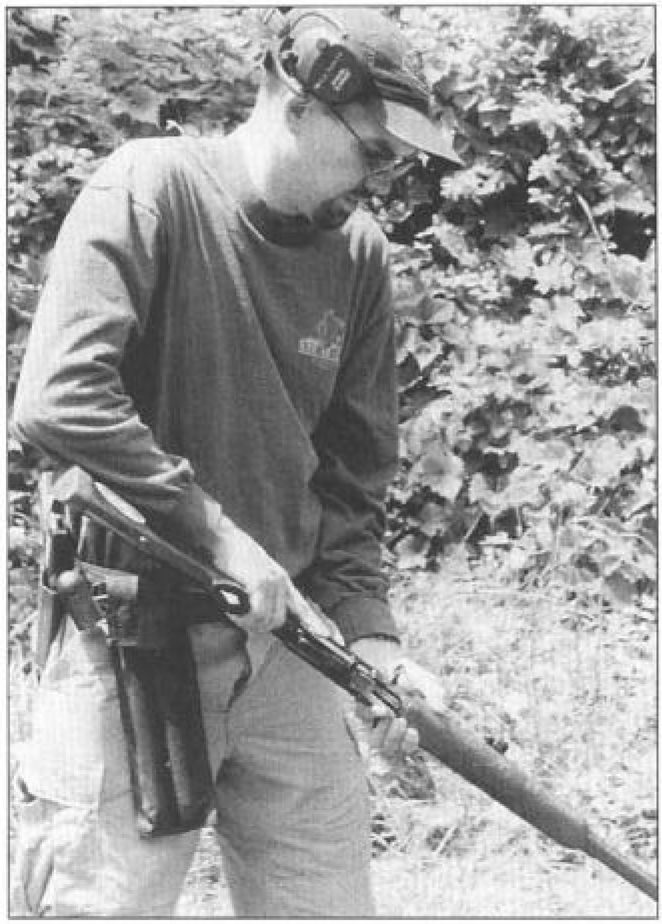
button. It is small and you can't guarantee it will unlatch, especially if you need to place one more shell into the gun by hand.

To unlatch the lifter certainly, Dave's Metal Works makes an oversized latch that is also a funnel for the reloaded shell. To install it, begin by removing the trigger assembly from the receiver and remove the lifter as you did to install the 3-inch lifter. The lifter latch is held on the lifter by a pin. With a drift punch, remove the pin. The latch and its spring will squirm out and be a fussy pain to re-install. But first you have to fit the DMW latch. The new latch is an investment casting, and may be a tight fit into the lifter. Usually any binding will be on the two arms that pass through the slots in the lifter. Attempt to press the latch into place and see if it binds. If it does, use a fine file to smooth and even the binding surfaces. You want the new latch to fit smoothly and without binding, but not wobble.

***When it's time to load, bring the shotgun down and turn it upside down*.**

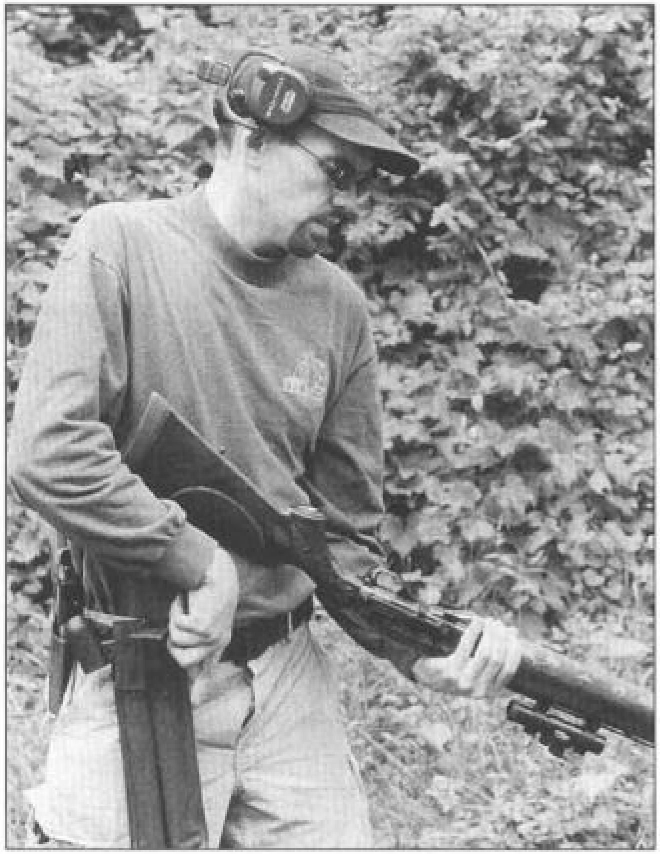
Once the DMW latch fits without binding, you have to reinstall the pivot pin and the activator spring. The roll pin can be a three-handed hassle to install. One way to make the job easier is to use a solid pin instead. However, the solid pin will fall out or drift from side to side. What I did to avoid either problem was to turn a small cylinder on the lathe. I bored a hole through the cylinder that fit the pin, and soldered the cylinder onto a

section of pin. The headed pin fits in the recess on the side of the lifter when the trigger assembly is in the receiver, and will not come out.

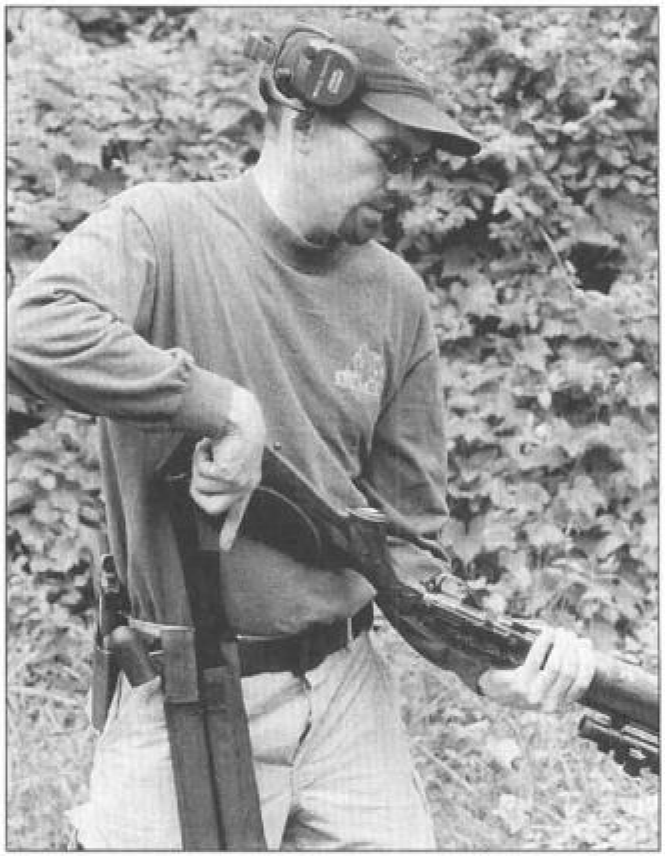


1. Slide the front hand back and support the shotgun.

2. Push the stock in against your body to keep it steady.

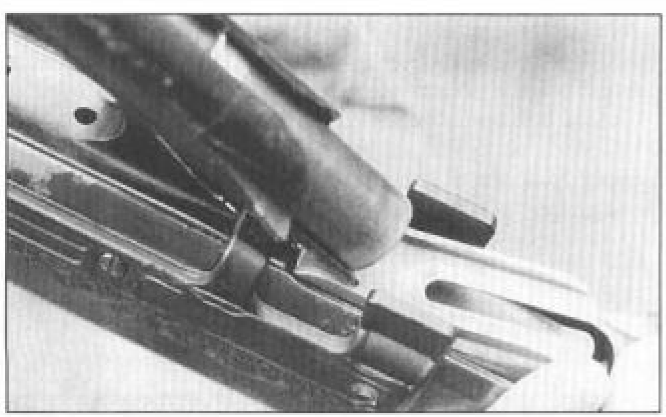


3. Reach back and grab the loading tube.

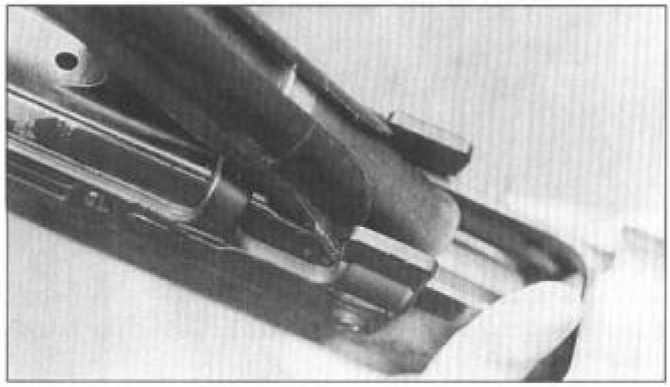


4. Pull it out of the pouch.

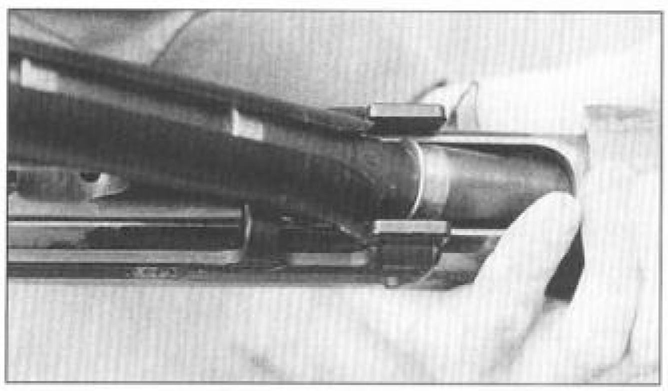
Lock the wings of the tube under the tabs of the bracket, and line the tube up just over the pistol grip of the stock, then push straight forward through the tube.



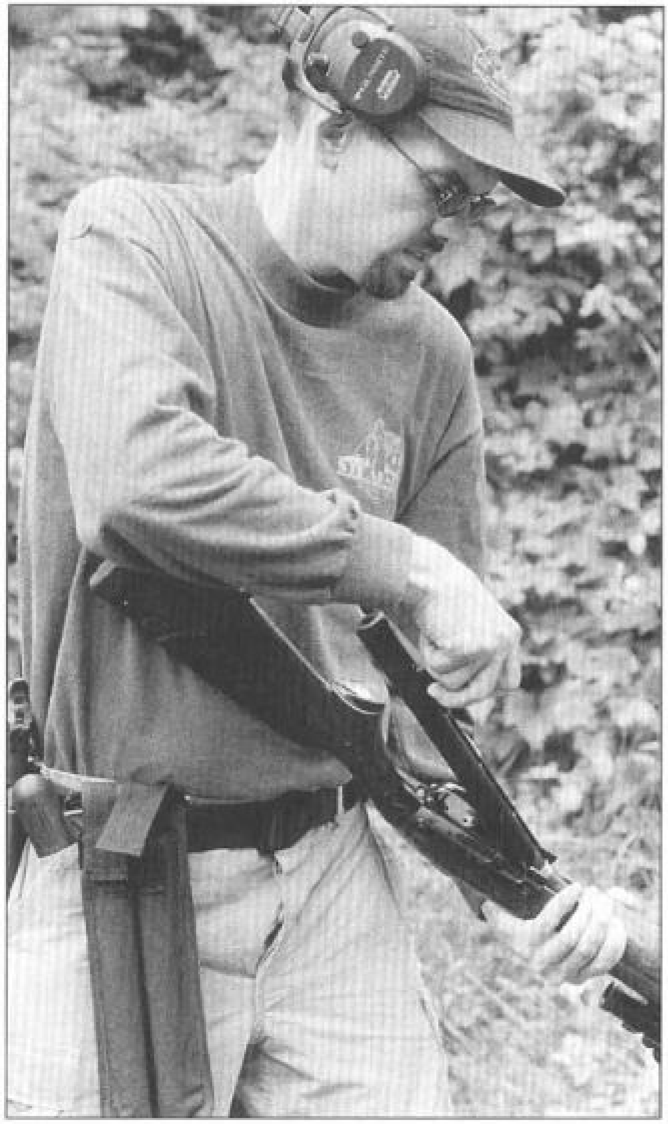
Here you see the loading tube coming up to the tabs, just prior to depressing the release button (in this case a DMW loading gate.)



Here the loading tube has unlatched the lifter, and the first shell is feeding out.



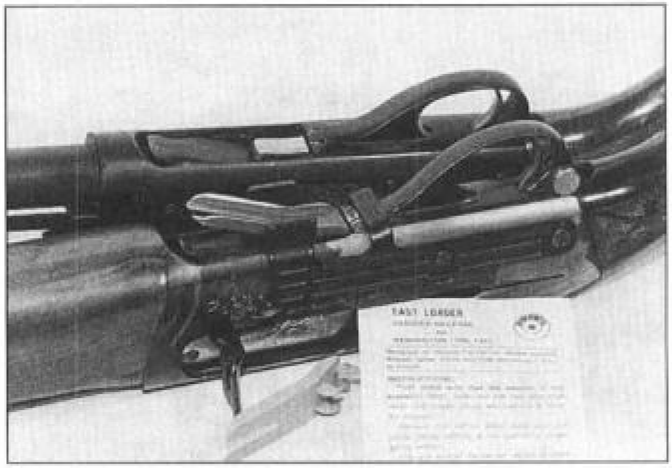
The shells snake into the magazine tube, guided by the loader.



Push straight down the length of the loading tube.

Push until the handle of the guide goes into the magazine tube.

Let go of the magazine tube loader, raise the gun and complete the course.



You can see how much larger the DMW carrier release is compared to the factory button.

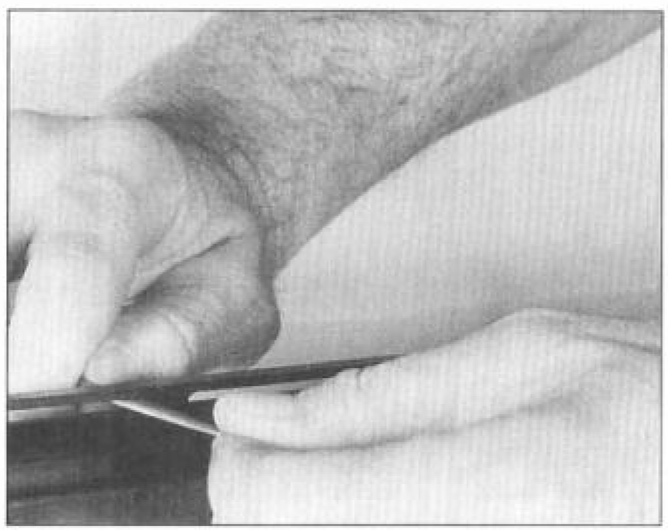
If you are reinstalling the roll pin, you'll need a hammer and drift punch, the trigger assembly parts and a large pair of vise grips. You can't simply clamp the lifter in your vise, it is oddly shaped and delicate. Lay the lifter on its side on your bench and clamp the end of it with the vise grips. Clamp so the vise grips hold the lifter so it is edge-up on the bench. Assemble the spring and latch to the lifter. Hold the pin to the top of the hole and start it into the lifter by gently tapping with the hammer. As the pin approaches the latch leg, press the latch in line with the pin and continue drifting it into place.

Once the new latch is installed, reassemble the lifter to the trigger assembly and check the timing of the lifter (You didn't go through all this work on a 2-¾-inch lifter, did you?) Use the instructions in Chapter Sixteen to make sure the anti-bounce tab catches the lifter tab smoothly.

Replace the small operating handle that comes with the 1100 with an oversized operating handle from Choate. Simply grasp the old one and yank it out. Press the new on in its place.

Use a long forcing cone reamer to lengthen the forcing cone. As it benefits clay bird shooters with fewer deformed pellets and more uniform patterns, so it benefits the PSC shooter.

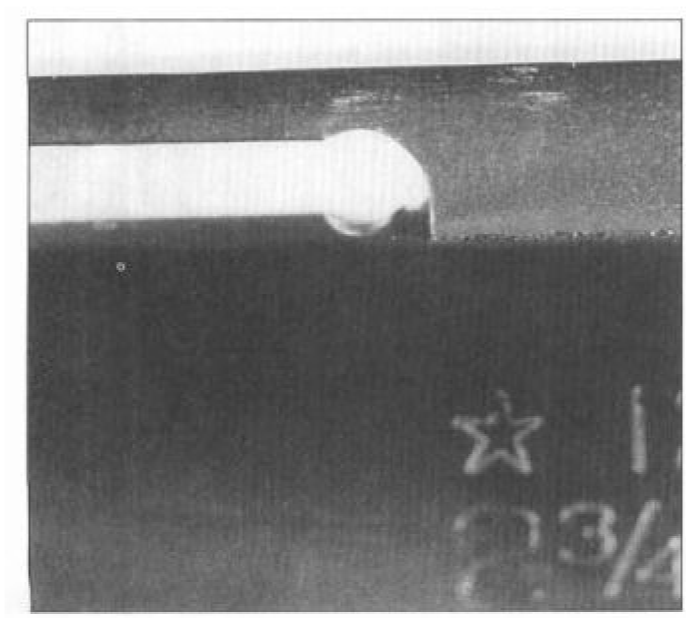
Especially if you are loading one shell at a time, the DMW release helps a lot.



Using a round needle file on the rib posts to create clearance and locations for the modified scope rings.

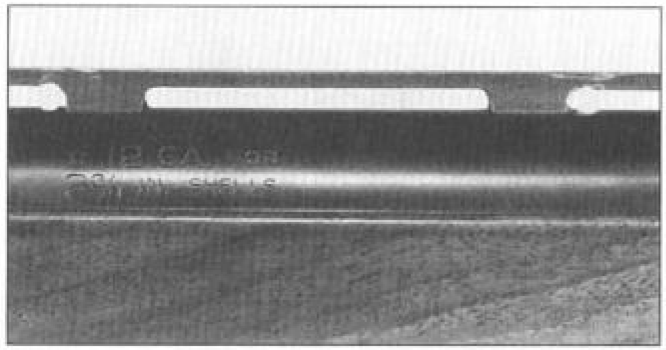
If you are sticking with iron sights, you can replace the simple brass bead with a fluorescent fiber optic bead front, or a turkey gun three-bead setup. Or, you can go with a ghost ring rear and post front. For that work, see Chapter Nine.

Most competitors who shoot in the Open class decide to go with optics of some kind. While many shooters mount their optics on the receiver, the most common and probably the best place is on the barrel. Most shooters use a ribbed barrel, as it provides a convenient place to mount the optics. One method is to modify rings that can clamp directly so the rib. One set of rings that can easily be modified are Millett. The rings will fit over the rib, but the bottom screws cannot pass under the rib. To allow the screws a chance at clearance, use a file to cut a rib-sized notch in the bottom of each ring, bringing it lower onto the rib. Once the screw will pass under the rib, you secure the rings front and back against recoil by using a small round file to provide clearance underneath the rib at the front and back of adjacent posts. The demo for this method is an old but still reliable Aimpoint red dot scope.



There is almost enough room, and the file completes the job.

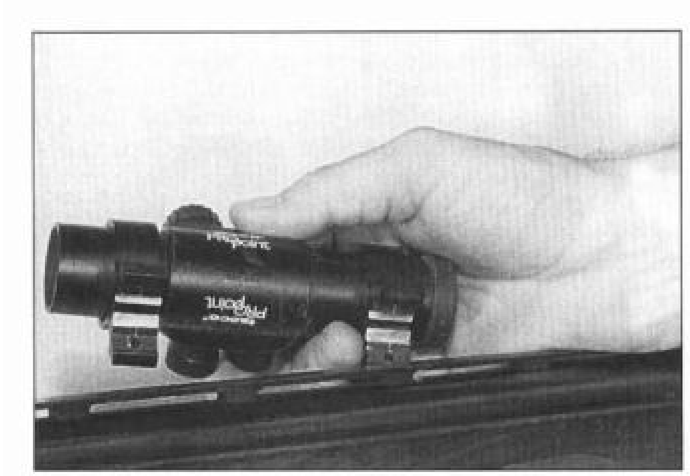
File in front of the forward post, and the rear of the rear post, to trap the posts between the rings.



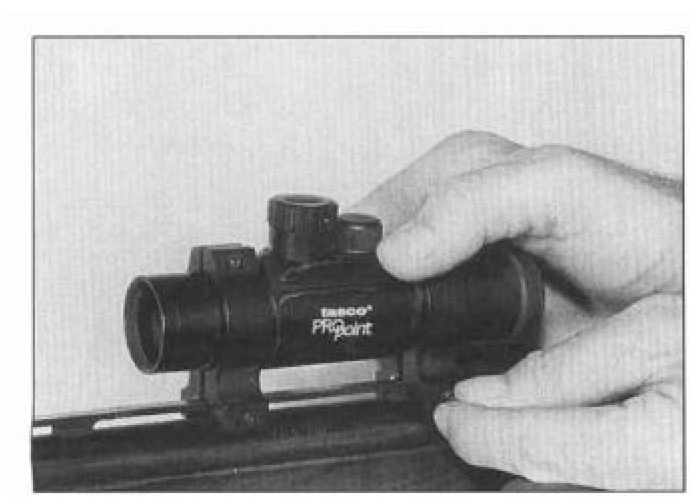
The high vibration from resting on the barrel calls for a little Loctite to keep the rings secure. To finish assembly, place the scope in the rings and install the upper screws but leave them loose. Slide the rings and scope onto the barrel and line them up with the prepared rib posts. Press the bottom screws through the rings and rib, and then tighten them. Once the bottom screws are tight, then tighten the top screws. Test fire and make sure you are zeroed. To use Loctite on the finished assembly, you need to loosen the screws to expose the threads. Rather than re-zero, loosen the screws one at a time. Loosen but don't remove. Place Loctite in the hole on the threads and re-tighten. Repeat on the other three screws.

To complete the clearance, file a groove in the bottom of the Millett rings for the rib top.

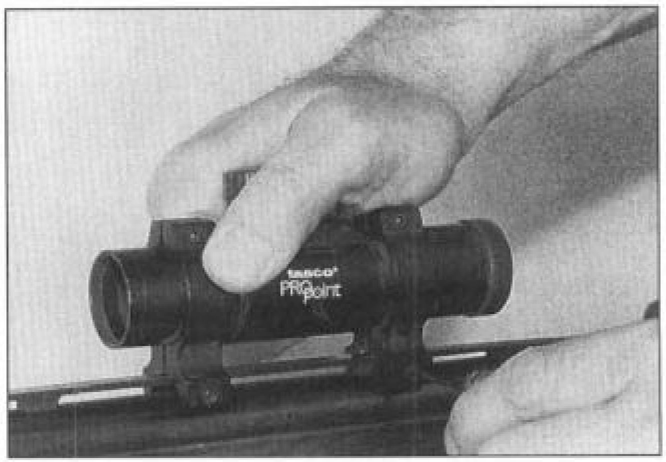
1. Here you can see the clearance slot filed on the bottom.



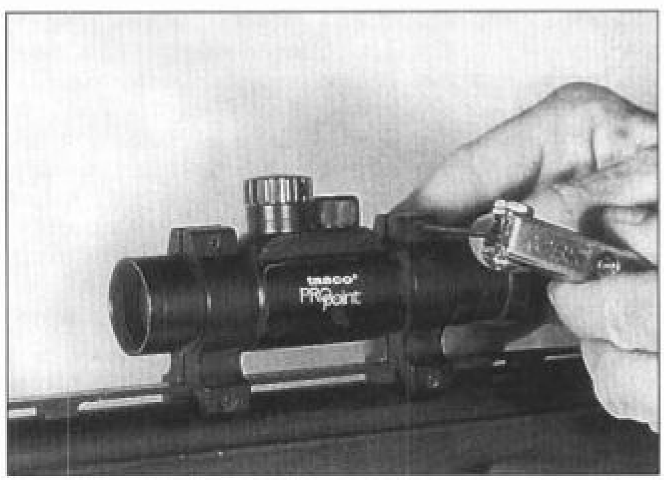
2. With the rings loosely assembled on the scope, rest them on the rib.



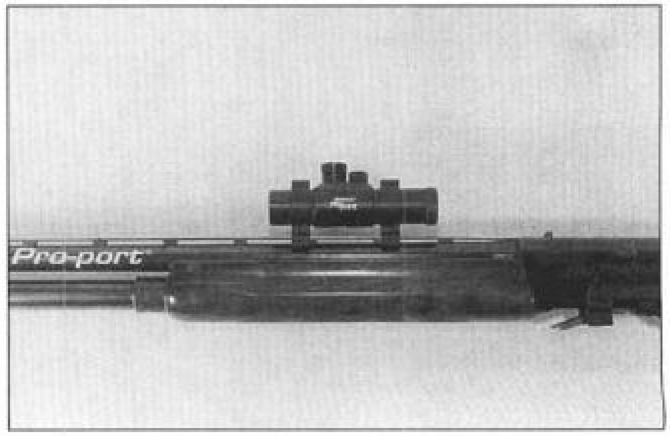
3. Slide the rings until you can press the screws through the filed grooves under the rib.



4. Line the scope up and tighten the screws, bottom….



5.… and top.



6. The completed assembly sits a bit high, and may need a rubber cheekpiece to raise your face. Since the rubber dampens recoil, great.

The advantage to this method is its simplicity. However, you can't take the scope off without completely losing your zero. Getting any lathe work or reaming done, or soaking the barrel with scope on are bad for the scope. A scope mounting that gives you a better chance of return to zero is a scope base attached to the rib, with the scope attached by rings. The method is described in Chapter Nine.

The magazine capacity will have to be increased. A magazine extension tube will do the trick. The extension tube is merely a magazine cap with a section of tube attached to it (and a hole for the shells to pass through!) that replaces the old cap. An extension can add one or two shells, or add up to seven more. All you need is length. The 17-shot tube I mentioned earlier stuck a foot and a half past the muzzle of the shotgun it was on. Most shooters prefer to keep the magazine extension flush with the muzzle. A 20-inch barrel can have an eight-shot capacity, a 26-inch barrel can have a 10-shot capacity, and a 30-inch barrel a can hold 12 rounds, flush to the muzzle. A tube that projects past the muzzle is not in any physical danger, but is unsightly. I shot a 10-shot tube on a 21 -inch barrel for a while, and the tube would get all caked with powder residue from the muzzle blast. But it worked fine.

Unscrew the old forearm cap and store it away. The current magazine spring is held in by a spring steel circular clip. Use a large screwdriver to pry it out of the end of the tube. Remove the spring, follower and retainer

and store them with the old cap. While you have the magazine open, swab it clean. You'll find an impressive amount of gunk in there.

If you have an 11/87 instead of an 1100, you need to change the sequence a little. Instead of the spring-clip retainer as on the 1100, the 11/87 uses two tabs punched into the magazine tube. To remove the retainer, find a screwdriver that fits the slot on the end of the retainer. Press the retainer down until it clears the tabs, turn it either direction a quarter-turn, and let the spring ease it out of the magazine. Getting a new follower to fit (the original one is slotted for removal, not for high capacity) means you have to remove the tabs. Removing the tabs is forever, and changes how the old parts work. Once the tabs are gone, you can't use the 11/87 spring retainer if you want to go back. Also, the new design uses the spring retainer as a method of keeping the magazine cap tightened. If you take the tabs out and then return the shotgun to its original configuration you must regularly check the magazine cap for tightness. If you are not planning to go back, removal is easy. While there are offset anvils you can buy to hammer the tabs flat (or you could make your own) the easy way is to drill or grind. Or do both. Drill the tabs out with a ¼-inch drill and then use a grinding stone on a handheld grinder to clean up the burrs and remove any leftover dimple of the tab. Clean all the drilling chips and grit out of the magazine tube and receiver, then continue upgrading.

Replace the follower, spring and cap with parts from Choate. The old follower is probably one of the molded plastic ones that are so endearing to accountants. If you are lucky enough to have an old 1100 that has a steel follower, then you may not need the Choate orange plastic one. The newer plastic ones by Remington work fine for clay birds and hunting, but for the demands of PSC you need the Choate or one like it. In addition to being solid, the Choate (and others like it) has a tail on it. The tail acts as a guide for the magazine spring as the spring is compressed. With the tail to stack over, the spring is less likely to kink under compression.

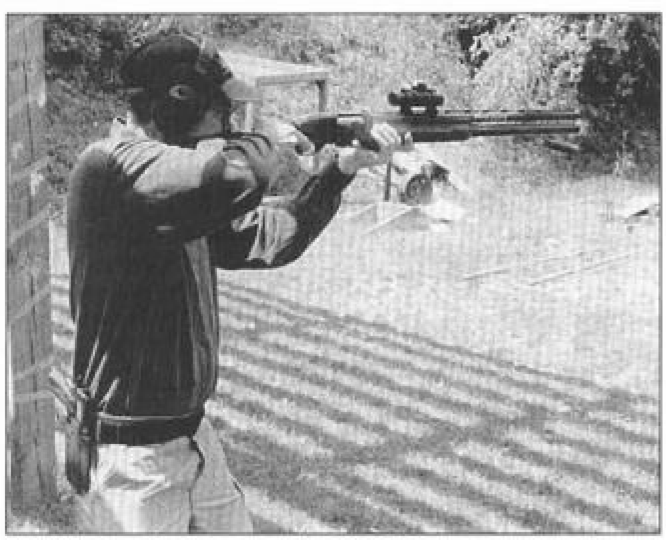
The new magazine tube comes with its own spring, long enough to fill the new tube. To assemble the magazine tube and spring, start with the rest of the shotgun assembled. Slide the follower into the end of the spring and slide the follower and spring down into the magazine tube. Slip the magazine extension over the other end of the spring. Stand the shotgun up and hold it with your left hand around the forearm at the magazine opening. With your right hand, compress the spring using the extension tube. At the

same time, use the fingertips of your left hand to press the loops of the spring into the magazine one by one and keep them there.

You will quickly walk the spring into the magazine. Once the extension tube is close enough, get the fingers of your left hand out of the way and screw the extension tube in place. Keep the tube tight, and check it regularly when you are practicing or in a match. The eight-shot extensions come bare, but the 10-shot extensions come with a clamp-on support bracket. The bracket clamps the barrel and extension tube to each other and keeps the tube from unscrewing. You can use the bracket as a sling swivel (its built in) but since there is no need to sling a shotgun in a match the only use the swivel sees is as the lever to lighten the bracket.

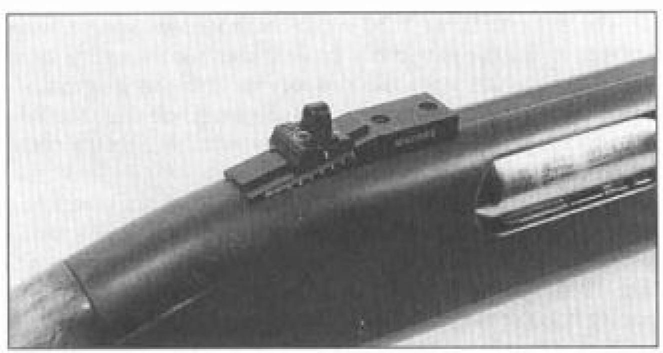
The Practical 870

In the old days, there were many myths that circulated about firearms. One was that revolvers were more reliable than automatics. Another was that revolvers were faster than autos. A third was that pumps were faster man autos. Competition has disproved all three. Revolvers are reliable, but not any more reliable than a good pistol being fed good ammo. The idea that a revolver was faster than a pistol probably came from comparing a .38 special revolver in double-action to a .45 auto. Fired with one hand, back when everyone thought the .45 had heavy recoil, I guess you might think the .38 to be faster.



For fast shooting, a red-dot scope is hard to beat.

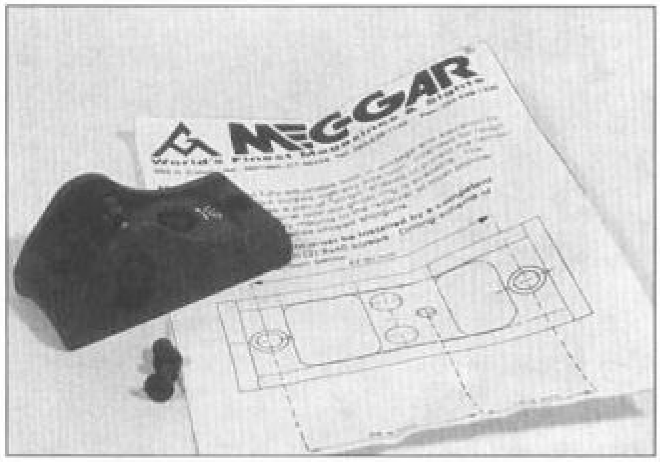
But pumps faster than autos? Even when I started shooting shotguns in PSC in the late 70s and early 80s there were shooters who believed that. I started shooting with a pump, but as soon as I got my hands on an auto I disproved the old notion. Autos are faster. As proof for the disbelieving, I offer my performance as a bowling pin shooter. The only two things that matter are that you drive all the pins off the table, and that you do it faster than anyone else. For an eight-pin table using buckshot, my fastest pump time in a match is 3.7 seconds. The time is measured from the blank start gun to the last pin hitting the ground. My time for auto is 2.7 seconds. Both are record or record-tying times at Second Chance. My practice times at the club are even faster, but stilt show the pump/auto spread of about a second. If a pump was faster than an auto, the times would show it and I'd shoot a pump against the autos. So why shoot a pump? Maybe because you like it, or because the match has a pump category, or you don't want to spend even more money on gear and your pump works fine.



For those not fond of batteries, a ghost ring rear allows the use of shot and firing accurately with slugs.

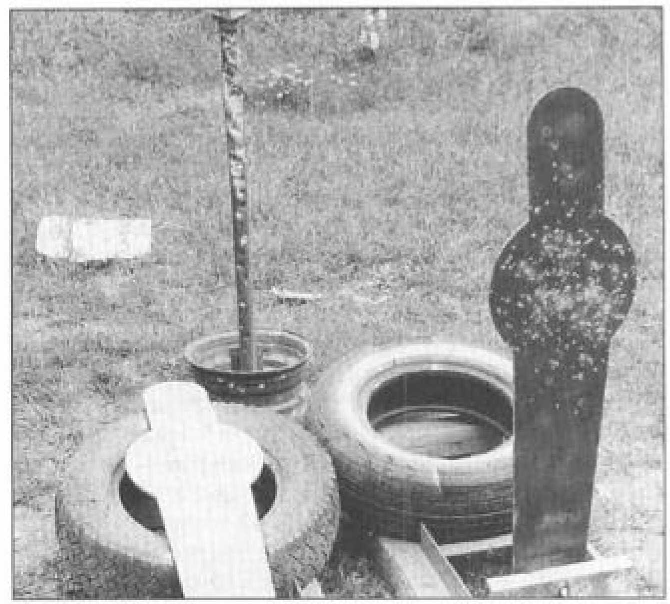
Building a pump involves many of the same aspects of building the auto. You will want a soft recoil pad on the stock, and a large-head safety. The forcing cone should be lengthened. You needn't worry about a 3-inch lifter since you do the lifting, not the shotgun. One thing you should look for on the Remington is an anti-bind lifter. On the Mossberg or the Winchester you needn't worry. The Moss-berg lifter is skeletonized and rests against the

bottom of the bolt slide when the action is closed. The Winchester 1300 does not lock up when double-fed. The Remington can.



The Mec-Gar ghost ring is all-steel and tough as nails.

In double-feeding the shell you are thumbing into the magazine tube doesn't quite make it far enough forward to be caught by the shell stop. Instead of going in far enough to be caught by the shell stop, you push it short and then release it. The shell pops out of the magazine tube and gets trapped between the lifter and the bolt slide. On older 870s this led to the action wedging tight when you tried to work the slide. Newer 870s have a modified lifter and slide that prevents this binding. You can identify them by the “U” shaped slot cut into the lifter.



In practical shotgun shooting, you have to put enough pellets on the plate to tip it over. This plate went down easily.

A double-fed 870 that has the new parts is a cinch. Cycle the action and the trapped round will be fed into the chamber.

What if your 870 does not have the anti-bind parts? Can you install them? Yes you can, but not at a reasonable cost. You need a new bolt, slide and lifter. It has been a long time since Remington has had to upgrade any law enforcement 870s. When I asked Remington about the parts kit, at first they didn't remember it. Then they told the the cost would be over $100. So what to do? If your 870 is sans the new parts, don't sweat it. The problem only occurs if you incorrectly feed a shell into the magazine. Train yourself to follow the shell into the magazine tube with the tip of your thumb. In the old days gun writers would suggest things like cutting a slot in the lifter so you could push the shell into the tube with a knife or a key. I tried that once, and once only. Consider your chances of pushing a shell back into the tube with a penknife or key, against the force of the magazine spring. (A clue: it ain't easy, especially if you installed an extra-power spring to make sure the shotgun feeds reliably.)

No, in a match you take a zero for the stage because any remedial action you can take would be viewed as unsafe in a match context. In a real life encounter you try the old method of clearing it. Put the safety on. Press and

hold down the slide release. Holding the slide release and the forearm, briskly strike the butt against the ground as you attempt to open the action. If this works (and the odds are only so-so) keep going. If it doesn't, go get another loaded gun to continue with. Any other course of action would take longer than getting another loaded gun. What if there isn't another loaded gun to be had? The only sure ways to clear the double feed (if the 870 does not have the new parts) are to either diassemble the magazine and slide the offending shell out, or remove the trigger housing assembly. Both take time. Good luck.

The best thing to do is to only build a PSC or defensive shotgun in an 870 when that 870 already has the anti-bind parts in it. Again, in a match gun I wouldn't sweat it, but for a defensive shotgun I would only build on a newer 870.

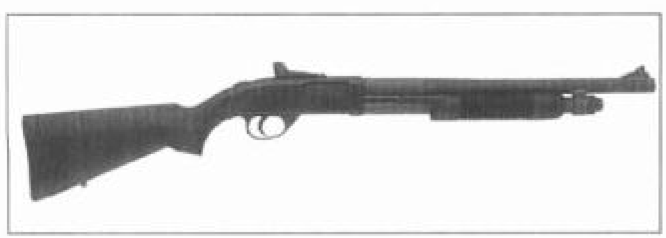
Building a competition gun on a pump, you have to have an idea of the rules and requirements of the match in which you'll he shooting. The question comes down to irons or optics. In irons, you have to know if you'll be shooting slugs or not. Some matches do not require slugs, others do. If you rarely shoot slugs, and can shoot them well enough with a double head, then that may be all the irons you need. If you shoot a ghost ring as fast as a double bead, or will be shooting slugs often, then you will want a ghost ring setup.

When building an optic-sighted or a double-bead 870, start with a ribbed barrel. For a ghost ring gun, a smoothbore rifle-sight barrel is the ticket. Unfortunately, the factory rifle sight barrels are only 21 inches long, and you can only get an eight-shot tube. The 10-shot tubes will stick out past the muzzle.

To slick up the action of the 870, flip back to Chapter Fifteen and polish the action bars and magazine tube. One additional aspect to look for concerns the fit of barrels and forearms. The shotgun's, not yours. When you switch barrels, the manufacturing tolerances can add up. On the demo 870, I had just such a problem. The shotgun, at one time, was owned by the San Bernardino Sheriff's Department. When they owned it, and when it came to me, it had a cut-down plain barrel with no choke in it. I put a new-production Remington rifle-sight barrel on it. The new barrel has thicker walls than the old barrel, and the forearm rubbed. At the rear end of the stroke, the top inside edges of the forearm rubbed against the barrel, and

made the bottom of the stroke heavier. The solution was simple, to relieve the rubbing edge of the forearm.

We are left with two aspects of a competition shotgun that are the subjects of a great deal of gun club conversation. Compensation and choking. Not of the types of each seen in professional sports, but something to control recoil and muzzle jump, and to control pattern size. Regardless of whether you are using a pump or an auto, you need both to shoot well. You can do well at the club level, if your club isn't too competitive, with an unchoked and uncomped shotgun. But you'll do so much better with these add-ons that you must look into them. The compensation is easy. Everyone understands the effects of recoil, and the benefits of reducing it. Choke in a “combat” shotgun is puzzling to many people. Operating under the assumption that wider is better, many assume that no choke is the best choke for a “combat” and a combat competition shotgun. No. Fliers outside the pattern do not do anything to bring down a steel plate. While a lucky shooter with a bad shot might tag a clay pigeon with a flier and chip it, a flier is not going to down a plate. If the plate is small, heavy or distant (relative to shotgun shooting) every pellet that strays from the pattern is one less pellet available for the job. For a Practical Shotgun match, the savvy competitor selects the choke that will give him (or her) the largest reliable spread on the farthest target.



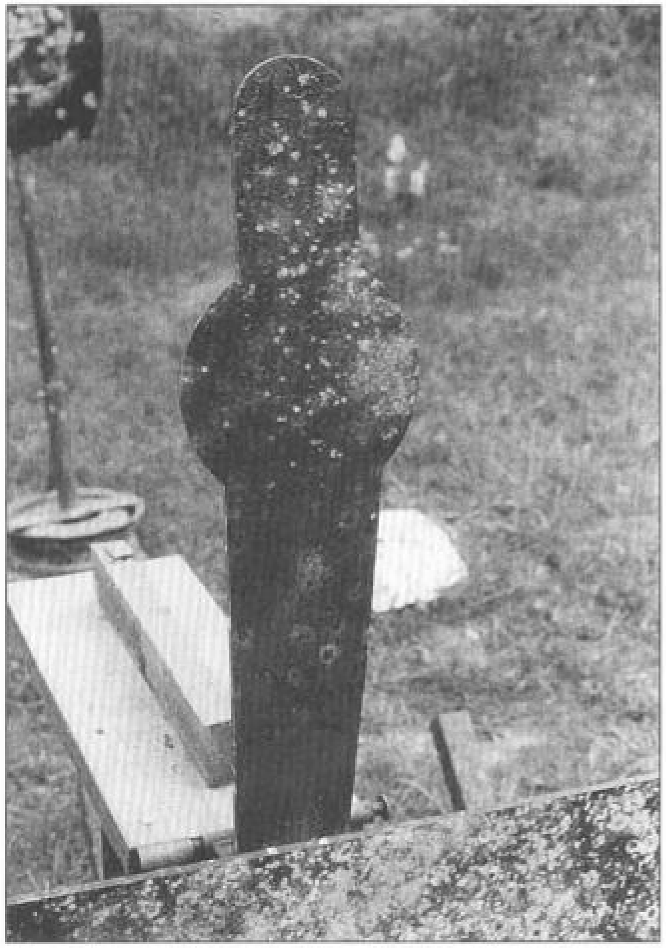
If you want to shoot both shot and slugs in a match, the Mossberg 590 Ghost Ring is a good choice.

Many PS competitors carry a box full of choke tubes just as any Sporting Clays shooter would. Depending on the target distance they may go anywhere from a Cylinder or spreader choke to Modified, and may switch between stages. Since each stage is timed, there is no hope of changing chokes during a stage. Bowling pin shooters do not have to worry about changing distances, the bowling pins are always going to be 25 feet away.

(At this point more than one shot-gunner will be exclaiming “Twenty-five feet?! How can they miss?” Quick answer; its easier to miss than you would think.) The choke requirements for bowling pin shooting are simple, since only buckshot is used. You need a pattern as large as possible while not being so large you don't get enough pellets on the pin to cleanly take it off the table. You also cannot have a pattern so large that you can have strays wandering into the next pin less than a foot away. Tipping the next pin makes shooting it harder, not easier. Most bowling pin shooters go with Improved Cylinder or Modified, depending on the performance their shotgun gives with the buckshot they will be using. Only pattern testing will determine which choke tube you should use.

You should build your PSC shotgun with interchangeable chokes. That way you can select the one appropriate for the match that day. If your barrel is a fixed-choke barrel, compare the cost of trading it or buying another to reaming or having your barrel reamed and threaded.

The last part of any competition shotgun is recoil control. For that we go to the next chapter.



This half-size plate takes fewer pellets, but this hit was marginal. The pattern center was high and right, and the fringe was just enough to take it down.

Chapter 21
Recoil Reduction

Newtonian physics explains why shooting a shotgun can hurt. The one that applies here is the Third law: “For every action there will be an equal and opposite reaction.”

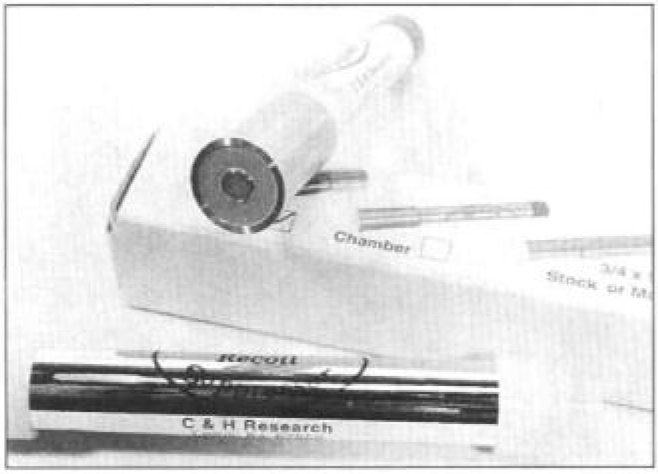
The heavier the payload, ;or the faster you push it, the harder the reaction, the recoil. There are four things you can do to mitigate the impact of the recoil. You can lessen the action, the payload, and thus the reaction, the recoil. You can increase the weight of the shotgun. You can improve the fit of the shotgun. And you can divert some of the combustion gases to counter the effects of recoil.

Before we go about decreasing it, we should discuss measuring it. The measure of recoil is two things, the momentum and the velocity of the moving shotgun. Fit simply determines how and where it hits you.

To calculate recoil, you need to know the weight of the gun, the payload and the ejecta. The ejecta is the weight of the shot, wad and powder.

Ejecta Reduction

Many shooters have done or are doing the first choice. A lighter load is softer in recoil and can be just as effective on clay birds. Think of it as losing the fliers. The only pellets that matter are the ones that stay in the pattern. If you control your pellet loss and end up with a pattern that has no fliers, you can fill the pattern while using less shot. By using hardened, plated shot in a buffered load, you can easily drop from 1-⅛-ounce loads to 1-ounce loads and not lose anything in effectiveness. There are even competitors who shoot ⅞-ounce loads without a decrease in their scores. Yes, the pattern is a little less forgiving than an older load with 1-⅛ ounces of shot and fliers, but the decreased recoil makes a big difference at the end of 100 birds.



The chamber insert tube includes a plastic snap cap center. In case you forget and try to fire again you won't damage your second firing pin.

The simple and fast way to measure recoil is weight times velocity. A 1-⅛-ounce of shot weighs 492 grains. Multiplied by 1200 fps, we come up with a Power Factor of 590,625. To make things easier, we'll drop the last three digits. Dropping the shot to 1 ounce gives us a PF of 524, a 12 percent decrease. Dropping again to ⅞ ounce, we have a PF of 458! The traditional method of measuring recoil is to convert weight and velocity to compatible measuring systems and come up with foot pounds and a recoil velocity in feet per second. Either way, the answer is the same, less payload means less recoil.

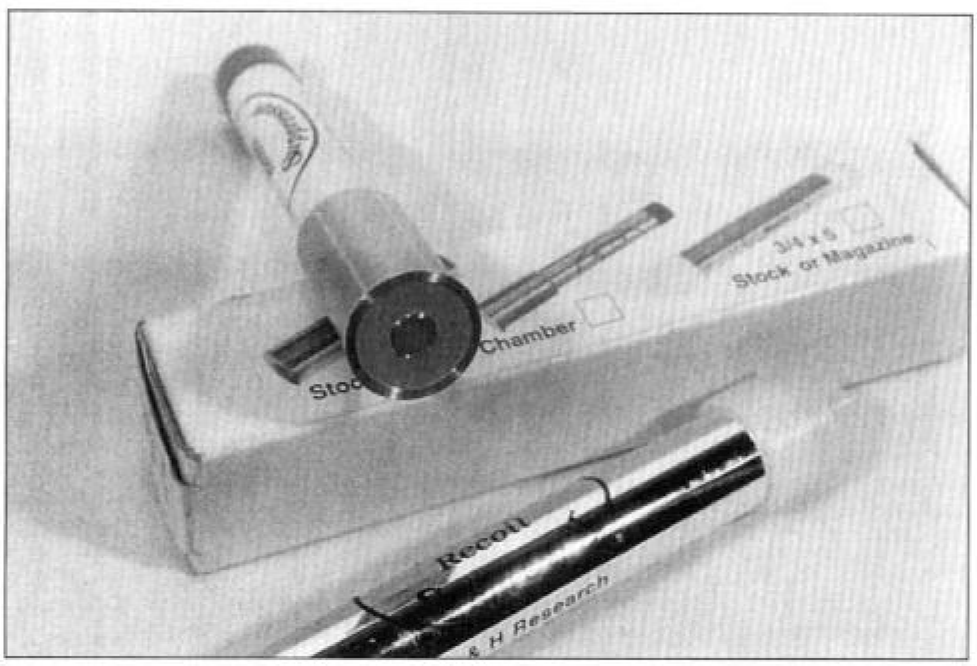
In this age of clean 100 birds requiring a shoot-off, we tend to think of ourselves as doing more shooting than any ever did. Not the case. The English viewed a shotgun as a gentleman's tool to harvest wild game, and did it with great enthusiasm. On one occasion, Sir Frederick Mill-bank shot 728 grouse in one day. He used a light load for the time, only ⅞ ounce of shot and a 2-¾ dram load. This was in 1872.

You can decrease recoil by using a smaller gauge. Dropping insert tubes into your double allows you to load 20-gauge shells in a 12-gauge gun, and launch a ½-ounce payload.

What if less payload is not an option? Duck and goose hunters can't get away with loading only ⅞ ounces of shot, no matter the lack of fliers. To get enough steel shot pellets to pass through a duck and bring it down at 50 yards, you have to start with a hull full of them. Turkey hunters have a

similar problem, in that they have to start with enough pellets to ensure that they will have at least three in the head of a Tom to a known distance. For those applications, some other avenue of recoil reduction must be pursued.

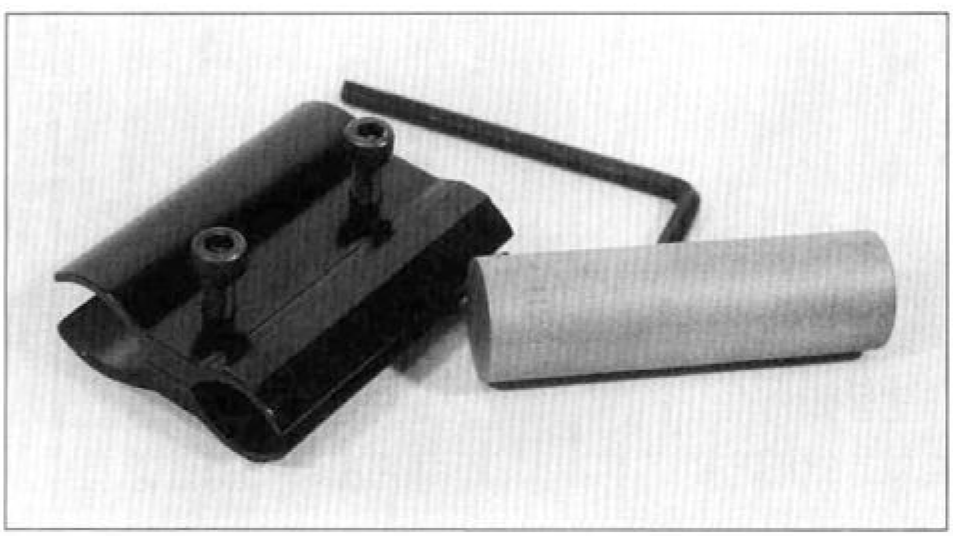
One way to reduce payload is with insert tubes.



Mercury recoil reducers add weight, and dampen recoil. The chamber insert is great for singles in Skeet and Trap.

Weight increases

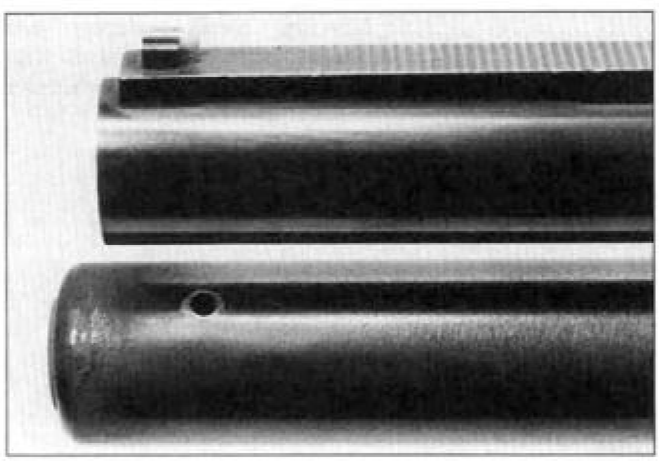
Shotgun weight helps. While the recoil force stays the same ("every action…equal and opposite") the extra weight decreases the velocity of the reaction. The total units of force of recoil are the same in a light gun and a heavy gun. However, the lighter gun will recoil with more velocity, and seem to kick harder. A heavier gun comes back more slowly, and gives more of a push than a snap. However, other laws come into effect when you start to adjust shotgun weight. Thorson's Restatement of the Second Law of Thermodynamics insists: "You can't get something for nothing." Adding weight to the shotgun affects its balance. Where you add weight determines how the balance is changed. If you add weight in the buttstock, you make the muzzle lighter (only in comparison, it actually stays the same) and whippier. If your shotgun was muzzle-sluggish before, great. If the balance was good before, this change is bad. Adding weight in front of your hands can turn a light, whippy gun into a smooth-tracking clay bird buster. If you can manage to add weight in between your hands, you can up the weight without changing the balance. While a turkey hunter doesn't have to worry too much about balance, hauling a heavy gun to the hunting location can be a hassle. When you add weight to your turkey gun, be sure to install sling swivels. A sling makes carrying a heavy shotgun a lot easier.



The barrel clamp model of recoil dampener adds weight out front, making your swing smoother and with a better follow through.

The trick is adding weight. Adding to the buttstock can be as easy as pouring shot into the stock bolt recess and tightening the recoil pad or buttplate on. However, you might want to use a small brass or steel plate screwed to the stock under the recoil pad to keep the shot in. One of the bowling pin shooters of our club used the poured-shot method, and the screws of his pad loosened under the recoil, dumping his shot out on the line one day.

To add weight out front, you can use a weighted magazine cap. A cap with a section of metal attached to it, the weighted cap looks like a short extended magazine tube. Another approach is to put weight in the magazine ahead of the spring and follower. I did this to my bowling pin shotgun, the weight helped, but I could feel the weight sliding back and forth under recoil on each shot. I ended up using a bolt and turned washer as a clamp, and secured the weight in the front of the magazine tube extension.

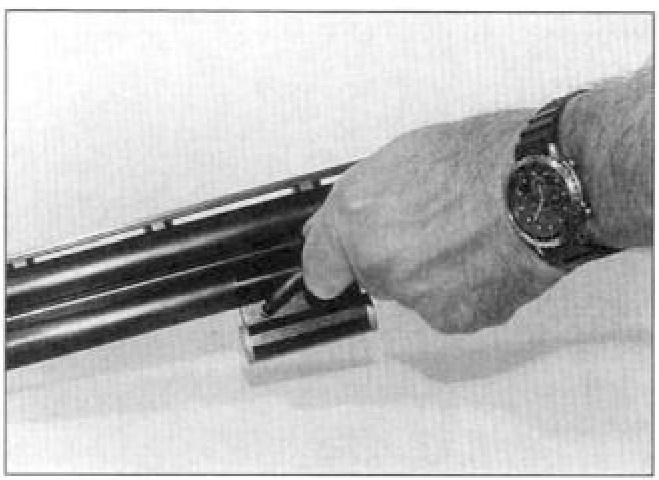


I experimented with a magazine tube weight. I needed to drill an access hole to install and remove the weight.

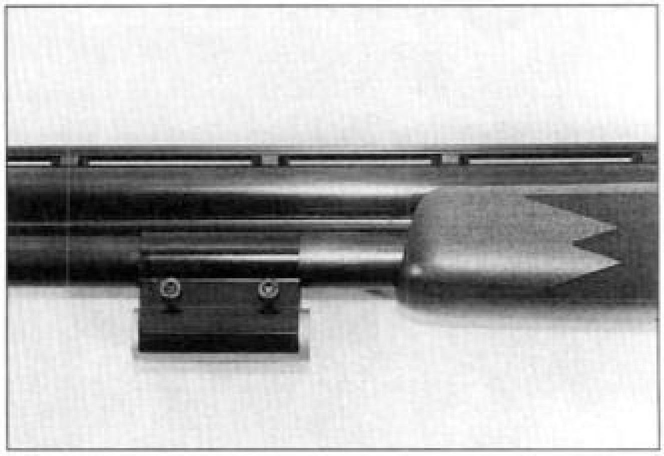
Adding weight out front on an over-and-under or side-by-side is not easy. Unless you are willing to clamp the weight to the barrel, there is only one other place to put it without turning your double shotgun into a single shot. Some gunsmiths will remove wood from the inside of the forearm and

anchor a lead ingot into the newly created slot. You need to remember two things if you are considering trying this: The first is that on many forearms, there's not much wood there to work with, so be careful before you start chiseling some out. Secondly. Never try to pour hot lead into the opening you've just carved out. Cast the ingot first, then trim it to size and secure it with a small screw. Another way to get more weight out front is to buy a shotgun with longer barrels. While skeet shooters shortened barrels from the traditional 30-inches down to 26, sporting clays shooters have the barrels back out to 30 or even 32 inches. Longer barrels swing more smoothly and are more likely to follow-through. However, if your double shotgun is already short, you can't lengthen it.

Weight in the middle can be just as tough. On a double, you can put weight in the second barrel, but if you are shooting sporting clays, what then? You need that second barrel. On a pump or auto, you can put a weight in the magazine tube in the feeding position, but again you are turning your shotgun into a single shot.



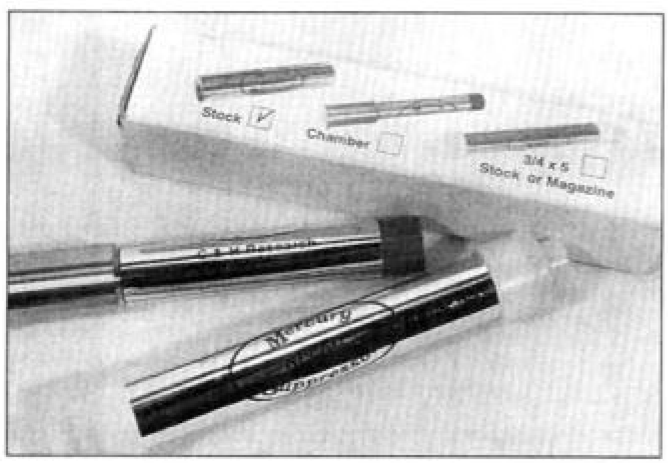
***Position the clamp and weight, and then tighten the screws to keep it in place*.**



***Adding the weight close to the forearm changes the balance least*.**

When it comes to weight, more is better until it changes the balance too much. To get the weight working overtime, you need to have a reactive mass. The mercury recoil reducers do just that. Mercury has a greater density than steel. Sealed in a steel tube, the mercury can slosh around under recoil and act like a dead-blow hammer. If you've never used one, a dead-blow hammer has a moving weight inside it. When you strike something with a regular hammer, it bounces off the struck object. In a dead-blow hammer, the inner weight moves to the rear of the hammer as you swing. When the face of the hammer strikes the object, the weight keeps moving. Just as the hammer is bouncing, the extra weight strikes the inside of the hammer face, deadening the bounce. The mercury in the recoil reducer does much the same thing. There isn't enough mercury, and it doesn't travel far enough to completely dampen the recoil, but it decreases the recoil some. And as we all know, some is better than none.

Adding the weight to the muzzle end maximizes its effect. This shotgun has every advantage, weight, ports, and a comped choke tube. Since it shoots buckshot, it needs it.



If you do not want to drill your stock, C&H Research will do it for you and install one of their tubes.

If you stock has a clearance hole for the stock bolt, you can slide a weight into the hole. If you want something a little neater than pouring shot in, you

can turn a steel bar in a lathe to fit the hole. Or a mercury recoil reducer wilt fit.

Lacking a clearance hole, you need to bore a hole for the weight. Start by measuring your stock, and seeing how much room you have. If all the mercury reducers are too wide, you'll have to use a steel bar. To drill a straight hole you need a bradpoint wood bit. You also need to use a large drill press. You cannot use a hand-held variable speed drill without a high risk of drilling out through the side of the stock. Measure the stock several times and lay the projected hole out on the side of your stock in masking tape just to be sure.

Drill the hole in several stages, and use the stop setting on the drill press to control depth. With the hole drilled, slide the weight in and secure it. The simplest method of securing the weight is to put a layer of duct tape (yes, duct tape) over the hole and under the buttplate or recoil pad. You want the weight to be firmly secured in the stock. If it can slide in the hole, it could crack a plastic buttplate, or cause an annoying nudge against a metal or rubber one. On my initial Second Chance slug gun, I secured the weight with epoxy. The gun was only going to see rifled slugs, and it was going to see a lot of them. In order to fit it into the stock I left the front end of the hole very thin against the outside of the stock. I didn't want the weight cracking the stock or bumping the recoil pad.

Use different-sized mercury tubes if you are going to stuff one in the magazine.

One slight problem to increasing the weight of a shotgun, even if you keep the balance the same, is fatigue. Hefting a 10-pound shotgun instead of a 9-pound shotgun adds up during a long string of clay birds. If you decide to increase the weight of your shotgun to reduce the effects of recoil, do not expect your scores to improve for a while. It will take you time to learn the new swing of the heavier shotgun, and to build up your strength to swing it. If you add the weight and feet the dampened recoil, but don't see an improvement in your scores for the next couple of weeks, you may quit too soon. Stick with it.

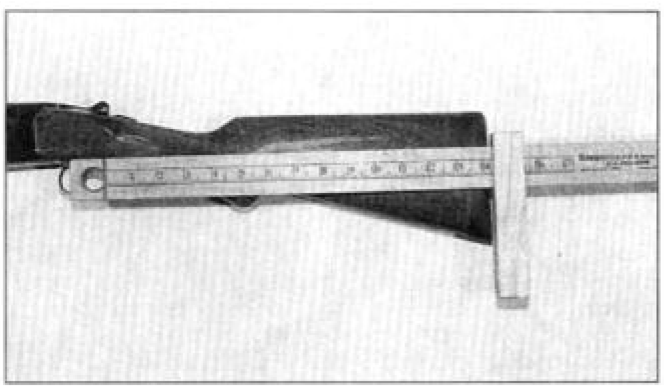
As in the decreased payload section, insert tubes in a double can be a viable option. While you aren't increasing the weight of the gun much, at 10 ounces for a tube set, you do increase it slightly, and you do greatly increase the ratio of gun weight to payload weight. If you have gotten recoil-sensitive, switching to a tube set in your double can take the pounding out

without requiring that you switch guns. With the lighter recoil and slightly heavier gun, you can keep shooting and work through your problem.

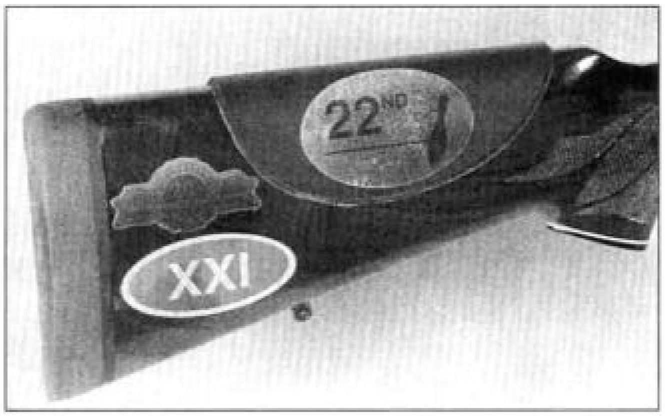
Perfect Fit and Padding

It should be obvious that a properly-fitting shotgun would hurt less during recoil than an improperly fitting one. We covered this in Chapter Five, but it bears repeating for the recoil-sensitive. To lessen the effects of recoil you should have a stock that is the correct length for you, with a round comb and a wide buttplate. A soft rubber recoil pad goes a long way to soaking up recoil without your shoulder feeling the effects. Not all shooters object to the recoil against their shoulder, but rather object to the hit their face takes when the gun goes off. To ease the impact on your cheekbone, use a Kick Eeze comb pad. A thin 1/16-inch pad will lessen the feeling without moving your pattern. The thicker pads will decrease the impact even more while moving your pattern only a couple of inches upwards at 40 yards.

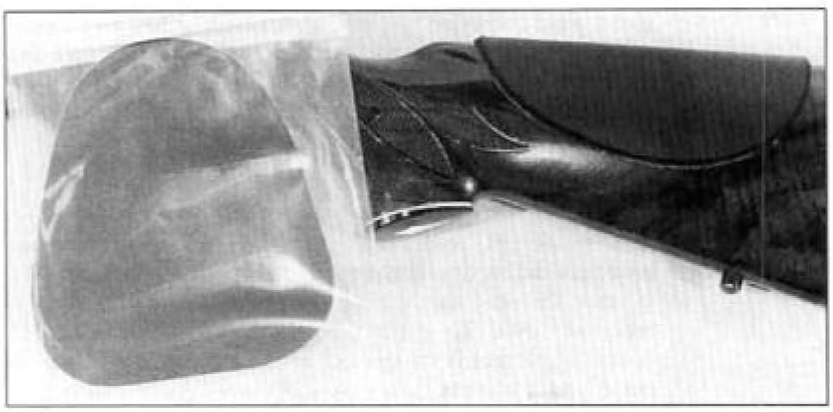
Shooting technique also makes a difference. When mounting the shotgun, be sure to pull the stock tightly into your shoulder, and press your cheek firmly to the comb. If you hold the stock away from you, or let your face "float" above the stock, you actually make the impact worse. With the shotgun held away from you, it can get a running start when it is fired, and you have to stop it.



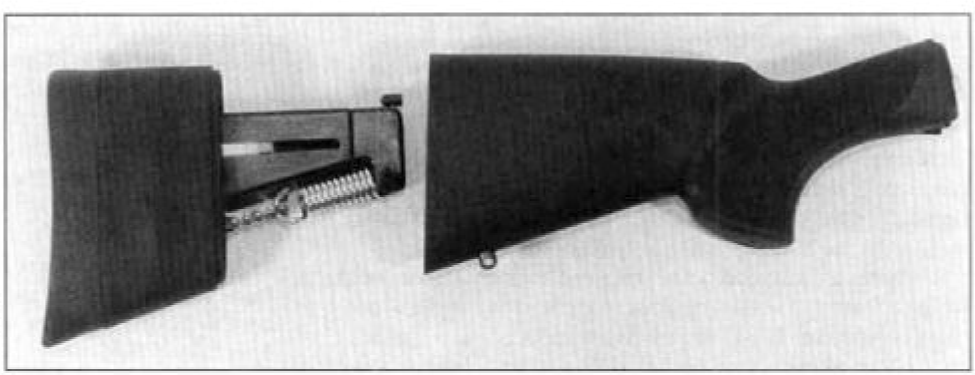
Pull and drop are important components of comfortable fit. Add a pad and make your stock longer, and it will be softer to shoot.



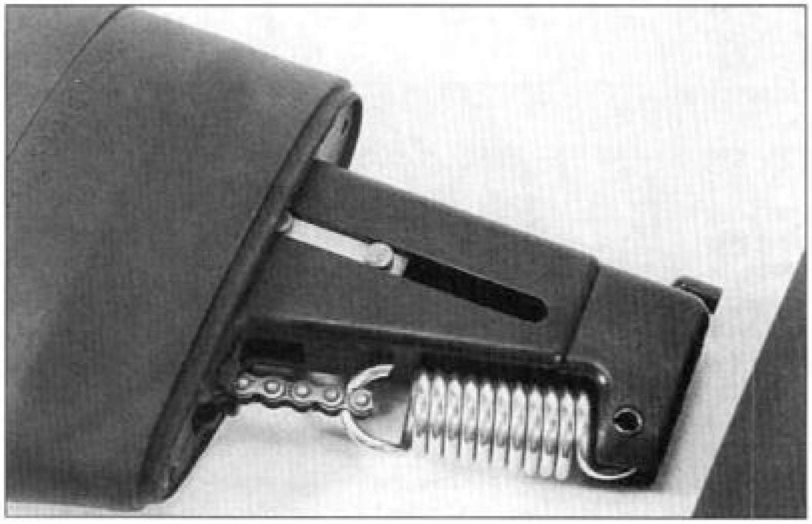
Rubber where the stock meets your face and shoulder soften felt recoil



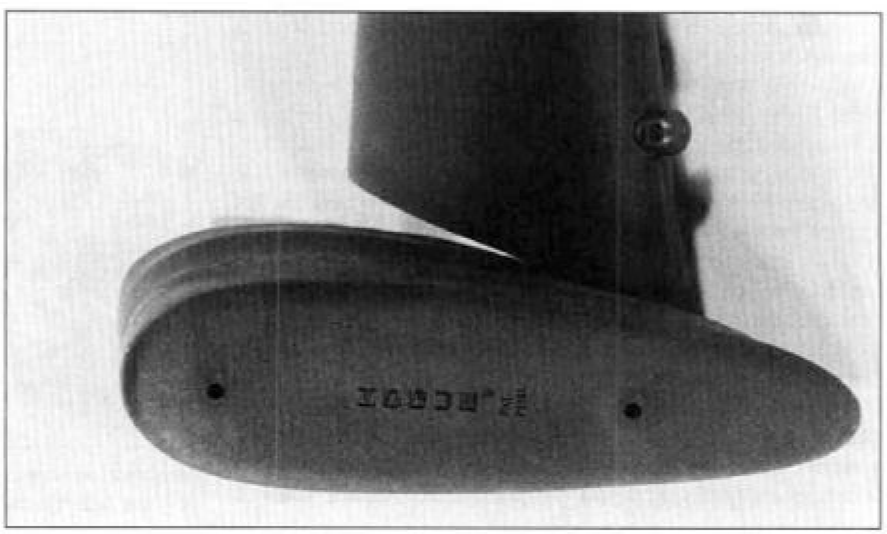
An adhesive-backed cheek piece can raise the comb and soften the hit to your face.



This Hogue stock replaces a regular stock. Recoil compresses the stock, working the spring.



The heavy spring in the Hogue stock dampens recoil.



The soft rubber of the recoil pad helps the spring mechanism dampen recoil.

***The chair is too high for this bench, and the shooter is leaning in too far*.**

While you could argue that physics says you have accepted the same amount of recoil energy both ways, experience tells us that starting tight hurts less. And, with your face above the stock, you will not be consistently aiming, and miss birds as a result.

When you are pattern testing at the range, there are a few things you can do to take the sting out of your research. Bench size matters. If you are shooting off of a bench that is too low, you will have to lean forward to aim and fire the shotgun. Hunched forward, you will not be able to roll with the recoil and thus will be sore after a short test session. Use a high bench, or a bench with a tail shooting rest on it. You want to be able to sit upright while you test fire. At the bench you can drape a towel over your shoulder and rest the butt of the shotgun on the towel. The towel adds padding and slightly increases the effective surface area of the buttplate. Also bring a couple of washcloths or small towels for your elbows. Resting your elbows on a wood bench or worse yet a concrete-topped shooting bench gets old quickly. With a little padding you'll be shooting in comfort.

By using a lower chair, the shooter can sit upright and lessen the felt recoil by rolling with it.

Diversion Programs

We come to what many shooters think of as actual recoil reduction, ports and comps. They have become so ingrained to think of using the combustion gases as a recoil fix that they overlook everything else. Consider ports and comps last. A ported shotgun with a stock that doesn't fit you is still going to hurt when you shoot it. To understand why ports are not a panacea, we have to go into what recoil is, and how ports affect it.

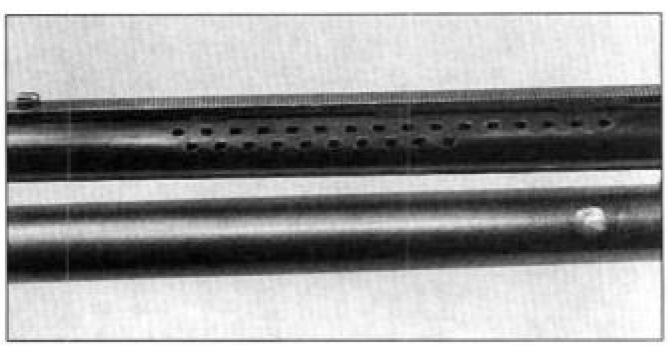
There is no statute of limitations on recoil. The moment the payload begins moving, recoil happens. Many shooters do not consider the fact that there is a definite time period during which the powder is burning and the shotcup and its payload are moving, but they have not left the muzzle yet. If we fire a standard target load of 1,200 feet per second, and assume it immediately reaches muzzle velocity (calculating acceleration is more precision than we need right now) we can get a rough idea of barrel time. In a 28-inch barrel, it would take .023 seconds for the shot to clear the muzzle. Since the payload has to accelerate up to that speed, it would actually take a little longer. Regardless of how long it takes, the rest of the shotgun is reacting to the movement.

With the proper positioning, comfortable shooting is easy. All these slugs went downrange in a day's shooting. The proper steps were taken to allow the shooters to do this without pain.

Ports or comps divert some of the combustion gases up or up and back, to use the barrel of the shotgun as a lever and counteract recoil. But the shotgun has a head start. It started moving as soon as the payload started moving, and has the full barrel time to build up momentum. When the powder gases are finally diverted, they can't counteract the recoil that has already happened.

That said, how well do ports work? Pretty darned well. Diverting muzzle gases to counteract recoil is not new, and not always impressive. The Thompson submachine gun was intended to make the difference in the trench warfare of World War I, and it had a muzzle brake on it. It doesn't seem to make much difference in any of the Thompsons I've fired, which is a good lesson in the physics of ports and why shotguns can do better. The Thompson is heavy and the cartridge it fires is relatively low-powered. It weighs more than some Trap guns (more than 10 pounds) and fires a cartridge that on a good day has a Power Factor of 195. A shotgun of more than 10 pounds in weight is portly, and a skeet or trap load easily has a PF over 500. The .45 ACP is a low-pressure cartridge, and by the time the gases get to the end of the Thompson's barrel there is hardly any pressure left. While a shotgun load starts out at a lower peak pressure than the .45 ACP, the pressure does not drop off as quickly as the pistol load does. By the time the gas column reaches the ports or comps, there is still enough left to be useful.

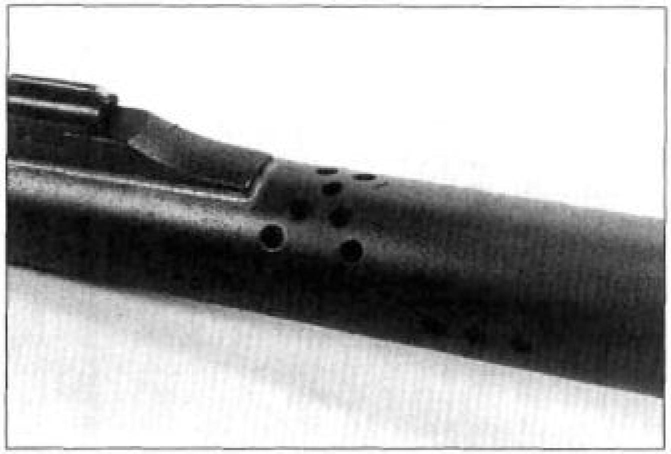
Choke tubes also are ported, to add every little bit of recoil reduction that is possible.



By the time the payload and its gas column have made it to the first port, the shotgun will have already begun recoiling. You can dampen recoil but you can't eliminate it.

***The birdcage extension on this Poly-choke helps to dampen recoil*.**

Between the wars, the same compensator that was used on the Thompson appeared on shotguns. The Cutts Compensator (aka “the pickle”) was quite popular for two reasons; one was that it lessened recoil, the other was that it was the first interchangeable choke system. The Cutts “cage” was an oversized cylinder with slots cut crossways in it. The slots were supposed to act as the muzzle brake, but I doubt they do much of that. They help a bit, but most of the felt recoil reduction comes from the choke. At the front of the cage the choke constriction is screwed in and constricts the shot. The payload jumps across the cage and squirms through the choke. The shot hitting the choke acts like the dead-blow hammer we discussed earlier. What caused the demise of the Cutts was not that it only helped a little in recoil, but that many shooters thought it ugly.



Porting is so accepted that factory guns have it now. The ports on this Mossberg 695 help keep the muzzle down.

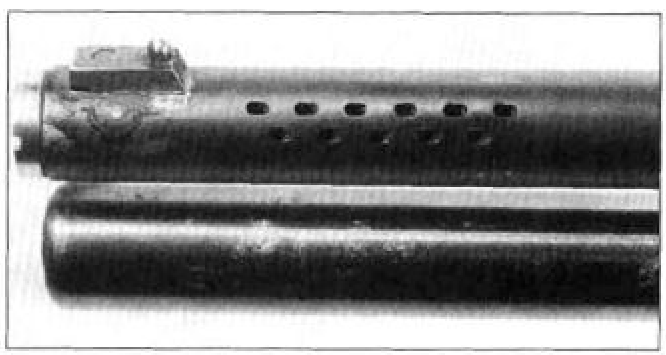
The modern approach to recoil reduction came as a spin-off of rocket science. Yes, thank NASA. Larry Kelly was a subcontractor cutting exhaust ports in rocket nozzles for NASA. To deal with the ultra-hard materials NASA presented to him, he used precision Electrical Discharge Machining. In EDM, the cutting tool is essentially a large spark plug with a huge electrical potential coursing through it. The spark can only jump a finite distance. When the electrode comes close enough to a conductive material, the spark jumps the gap. The spark erodes the conductive material as the electrode is passed through it. Since the spark can only jump so far, a faithful reproduction of the electrode is cut, plus the spark distance.

The end result is a hole cut with no heat, no chips, no burrs, no discoloration of bluing.

EDM is not new. It wasn't new when Larry Kelly was using it to cut nozzles for NASA. Many machine shops have an EDM machine to burn out broken taps and bolts. What was new was to use it to cut recoil-reducing exhaust ports in firearms. That, and the design of the ports was also new. Larry Kelly formed Mag-na-Port to use the patented process to cut holes in people's guns. At first the reaction was mixed. Some shooters objected to having holes in their guns. Others saw the advantages. The invention of Mag-na-Porting came about just as handgun hunting started to gain interest. Handgun hunters, even with “powerful” cartridges, are underpowered by rifle standards. More power was better, but there was only so much recoil a

handgun shooter could put up with. But with porting things were different. All of a sudden the “Worlds most powerful handgun” (the .44 Magnum of Dirty Harry) became a pussycat. Porting became almost mandatory, and business took off. Once porting for handguns became accepted, the search was on for ports for shotguns. It didn't take long.

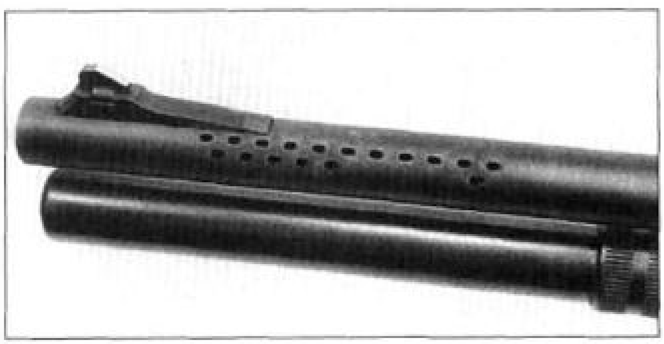
When it comes to recoil reduction, the more gas you can divert, the better. More holes means more diverted gas. To ease the cutting, Mag-na-Port built gang electrodes to burn the entire set of ports for a shotgun in one pass. Called Pigeon Porting, the arrays are built in several sets so you can mix and match the sets you want. My ported shotguns are all pumps or autos, but the ports can be used on over/unders, too. I'm sure you could do it to a side by side, but I don't recall ever seeing one. The gas bled off does not cause decreased velocity. Theoretically, and gas loss must result in velocity loss. However, the amount of gas bled off, as a percentage of the total amount produced, is so small it doesn't mailer. Velocity changes are so small they are swallowed up by variations in the shells and the atmospheric conditions. At 1,200 fps average velocity, who cares if the porting drops a couple of feet per second off the total? Even if the loss was 25 fps (2%) how much would it change your lead? Not one whit. There is no change in patterning performance.



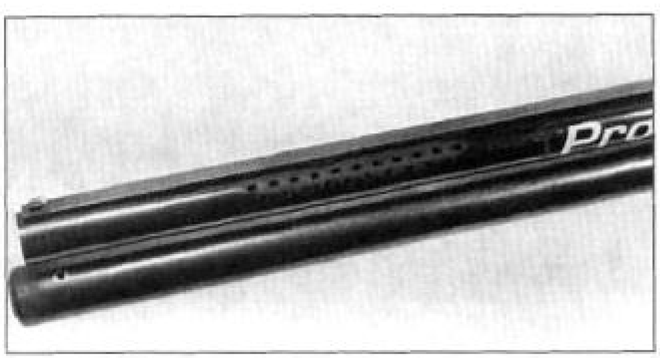
Here is the original Pro-Porting by Mag na Port.

I first started having Mag-na-Port put holes in my shotguns in the mid 1980s. Our club had been shooting bowling pins for a few years, and I had finally gotten up to Second Chance in 1984. I found it very much fun, and something I was good at. To have more fun I needed to shoot a shotgun. I

acquired a Military Finish Remington Model 11 and, since it was sans wood, fitted a stock and forearm to it. I had Mag-na-Port put their at the time standard Pigeon Port setup in it. The first and standard was 11 holes on each side of the barrel. With that gun, I talked J. Michael Plaxco into joining my friend Bart Ugguchioni and I as a three-man team. We placed third, and I was on my way. I placed “in the loot” every year after that using a shotgun. From 1986 until 1998, I won a gun or other prize in a shotgun event at Second Chance. Some years I would win in more than one event. As time went on, I added more holes. I talked Ken Kelly, son of Larry Kelly, into doing ever-more holes in a Pigeon Port job. At first he'd add an extra row, then I talked him into an extra set, finally, he gave up arguing and would burn the holes I wanted. My competition guns have one, one and a half, two, two and a half and three full sets of Pigeon porting. Here are the guns and why they have the porting they have:



By 1983, the original Pro-Port had been extended to Pigeon Porting. The extra holes help reduce recoil.

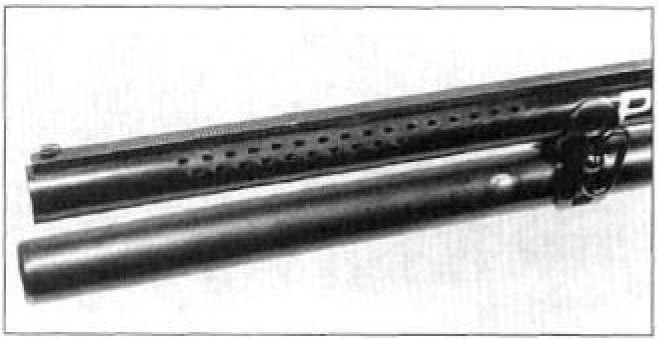


This photo shows two full sets of porting

The first, a Remington M-11 (I call it “Thumper” and it has failed the only once), only has the single set because I moved on to a Remington 1100. The M-11 is the slowest-cycling and hardest kicking shotgun of the bunch, and the Pigeon Porting just keeps the muzzle under control. However, those 22 holes (11 per side) and that shotgun set club records on pins that were years in standing. The only failure was my fault, and ammo related. It once extracted the brass off of a reloaded hull and left the plastic in the chamber.

The second is my Gunsite gun. Curiously enough, I call it that even though it hasn't been there. I started building it with the intention of taking it to the shotgun class, but ended up taking an 1100 instead. The GS-870 has a standard Pigeon Port set with an extra row. At the bottom rear of the row is one additional hole. So instead of a true one and a half Pigeon of 16 holes per side, I have a “One and a Half Plus” with 17 holes per side. If all I ever had to put through this gun was Federal Tactical buckshot loads, I might not even have the standard porting. But when the drill calls for slugs, porting is required.

The third is a Remington 1100 with a 2-¾-inch chamber and a 26-inch vented rib barrel. It has a double set of Pigeon Porting, with 42 holes, 21 per side. I did not add more ports than that because testing with the lightest skeet loads indicated that it would not always cycle. When the gun is clean, the ammo is new and the temperature is warm, the gun works 100 percent of the time. However, let the temperature drop, fail to clean the gun, or use reloaded light skeet loads and the gun will sometimes fail to cycle. With the present setup it works all the time, even cold, with reloads and dirty, when I feed it my standard competition load. If I were to add more ports I'd have to adjust the gas port hole to give it more gas flow, and I'm not willing to mess with a gun that works.



This Remington 870 has two and a half sets. Do not do this to an auto-loader, as you may bleed off too much gas and keep it from working reliably.

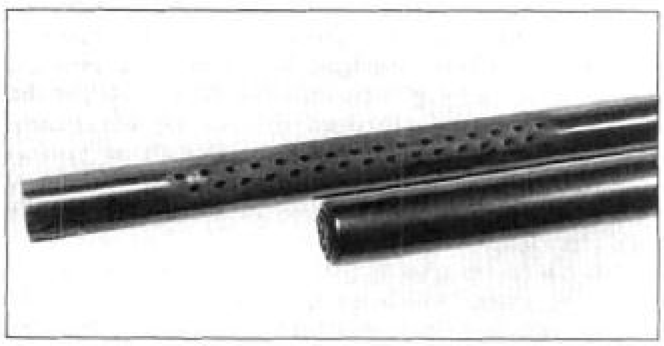
If you are thinking of getting your 1100 or 11–87 ported, I would not go more than a double set of Pigeon Porting, especially if you shoot reloads or are using a barrel shorter than 26 inches.

The fourth gun is my practical competition 870 (“Jack-hammer”) that, like the 1100, has a 2-¾-inch chamber and a 26-inch vented rib barrel. It has two and a half Pigeon Porting, with 26 ports per side. More might be better, but the muzzle does not come up from the row of pins in fast shooting. Unlike the 1100 I don't have to worry about the loss of gas to the gas port, so I could put as many as I wanted, but I haven't felt the need so far. If you are recoil sensitive and want to use a pump in competition, the two and a half Pigeon Porting is the way to go. Whether it would be for practical shooting competition, or clay birds, you will find your face liking these ports.

The fifth gun is the slug 1100. A 2-¾-inch 1100 with a Hastings rifled barrel, it has three full sets of Pigeon Porting, for a total of 31 ports per side. If you were to feed it skeet or trap loads not only would you be disappointed with the pattern (the rifling will spin the shotcup and blow the pattern) but it would not cycle. The ports bleed so much gas off that a skeet or trap load cannot cycle it. Since it is used only with slugs, the light load “problem” isn't one. I built it for use on the slug event at Second Chance, but it works just as well for local running deer matches and offhand slug matches. With its favorite slug load, and firing on the 90-yard plates at Second Chance, I can see the slug impact through the scope before the plate tips over. On a 50-yard running deer target, I can see the holes appear in the target as I'm shooting on each pass.

How many holes should your gun have? It depends on what ammo you will be feeding it, and whether you have a gas system to feed or not. For most applications, there is no need to go past two full sets. For goose or duck hunting, deer hunting or turkey hunting, you are not going to see any useful improvement past the two full sets. In a match, getting to the next plate a tenth of a second faster can mean the difference between winning and not winning a match. A tenth of a second means nothing trying to get a second shot on a deer, or try for a second duck or goose. And the improvement comes at the risk of having to adjust your gas system, a delicate and trying operation.

For pump shooters, you can go with the extra ports, and the only thing it will cost is the money to burn them. But you will not be getting the same value on the last holes as you are on the first. The law of diminishing returns is in full force once you go past the second full set of Pigeon ports.



Three full sets of porting on this slug barrel do not bleed off so much gas as to keep it from working. Slugs have plenty of gas pressure to work with.

Can you do it yourself? Yes. Should you? I have to say no. Let's go through the reasons one at a time. The only advantage is cost. If you drill or burn them, you are out your own time, and not cash and time of shipping to and from Mag-na-Port. (By the way, if you live in Michigan, you can drop in on a Saturday morning and they will do it while you wait. I have done it many times.) The cost is not great, and the savings hardly worth it. What are the negatives?

First, how are you going to get the holes evenly spaced? While I have been known to shoot some ugly guns, randomly-spaced ports are more than I can stand. If you are going to drill or burn you need repeatable spacing.

That means you either have to be drilling on a mill (or an EDM equivalent of a mill) or using a fixture. If you have a mill, go for it. If you buy a fixture, you've spent as much or more on the fixture as you would have on sending the barrel to Mag-na-Port.

Second, and this applies to drilling, how are you going to deal with the burrs that drilling will kick up? Even using a brand new carbide drill you will have burrs. (And what will the carbide drill be doing to your fixture?) You can use a polishing hone to polish the burrs off, at the cost of greatly decreasing the useful life of the honing stones. Or if you are willing to sacrifice a screw-in choke tube as a guide bushing, use an expandable reamer to clean the burrs off the inside of the bore. Either way, more cost and time. How much is your time worth? And if anything goes wrong, any theoretical savings are lost in the cost of a replacement barrel. I'm all for home gunsmithing (how could I not be?) but home porting is not on the recommended list.

Glossary

Automatic ejector

On a single-shot or double, an automatic ejector will toss the cartridge out of the mechanism when the action is opened.

Action

The main body of a firearm, that all the parts attach to or the rounds feed through. also: Receiver

Back-boring

The standard dimension of a 12-gauge is a nominal .729″ diameter. A back-bored barrel is one where the bore is reamed to a larger diameter, but the chamber is left a standard 12-gauge chamber. Made possible by the effective gas-sealing properties of plastic wads, back-boring decreases recoil and creates greater uniformity of patterns.

Black powder

A mixture of charcoal, sulfur and potassium nitrate, black powder had been the only gunpowder for centuries. At the end of the 19th century it was replaced by smokeless powder. Black powder is actually a low-grade explosive and not a fast-combusting solid like smokeless powder. Black powder is bulky and produces large amounts of white smoke. The combustion residue of black powder is large, and can foul the barrel of a shotgun to the point of making it inoperative. The residue is also hygroscopic, that is it attracts moisture. Firearms shot with black powder and not immediately cleaned can be rusted into scrap in a short time.

Bluing

A chemical treatment of the surface of steel to slow down the rate of rusting. In industrial applications, bluing is considered only a cosmetic treatment, as it offers little real protection. It is the traditional treatment for firearms, and offers enough to stay around.

Bore

***noun* - 1**. The section of the interior of shotgun barrel extending from the forcing cone to the choke. **2**. The measure of a shotgun barrel inner diameter. The traditional and British method was to equate the inside diameter of the barrel to the size ball of lead it could accommodate. A pound of lead divided into 12 equal balls, produced balls of “12 bore” diameter. A barrel that could shoot them was a 12-bore. Similarly for 16, 20 and 28. In the U.S., the term gauge replaced bore. The .410 is not a “four-ten bore” but the actual inner diameter of the barrel. ***verb* -** Another term for drilling, and for reaming. Boring is done on a lathe, either with a drill bit in the tailstock as the cutting tool to create a hole, or with a “boring bit” to ream a hole larger.

Bowling pins

A form of competition involving the standard ten-pin bowling pin, on a steel table at 25 feet. The shooter who can shoot them off the table the fastest wins.

Brazing

Fastening two or more pieces of metal with a connecting layer of dissimilar alloy containing copper.

Breech

The rear of a barrel, synonymous with chamber.

Breechloader

A shotgun that could be loaded from the rear of the barrel instead of the muzzle. Despite the many safety advantages (the thought of putting your hands in front of the barrel while loading it strikes many shooters with the willies) it took a while for the breechloader to become accepted. The big obstacle was sealing the breech against firing once it had been closed. Spouts of flame coming out of the rear, so close to your face, are worse than putting your hands out front while loading. Breechloaders did not become popular until self-contained cartridges became reliable.

Browning

A surface treatment to reduce or eliminate (it usually only slows down) rust.

Browning, John Moses

The most prolific arms designer of the end of the 19th and early 20th centuries (some might argue of all time). He designed everything but a revolver, and ensured the fortunes of Winchester, Colt and Fabrique National.

Buttplate

The rear of the stock, where the stock rests against the shooter.

Cartridge

A container that holds all necessary components to fire a shotgun. Unlike a muzzleloader with separate components, the cartridge wraps powder, shot, wad and primer into an easy-to-handle package. The muzzleloader was difficult to clean, being a sealed tube, as opposed to the breechloader, a tube open at both ends. A breechloader could be loaded or unloaded quickly. The expended cartridge, called a “hull” can be cleaned and reloaded with new components and fired again.

Cast-off

The distance the buttstock is offset, to the right, from the centerline of the bore or bores. When the offset is to the left it is called cast-on for a right -handed Shooter.

Centerfire

A cartridge where the primer is located in the center of the base of the case. As opposed to rimfire, where the priming compound is distributed in the rim of the case.

Chamber

The section at the rear of the barrel where the cartridge rests. Chambers are created for a cartridge of a particular gauge and a particular length. While a shotgun can be fired with a cartridge of the same gauge but shorter, it cannot be fired with a smaller gauge cartridge of the same length.

Checkering

A method of creating a non-slip surface, checkering is a series of parallel grooves crossed with another series of parallel grooves. Checkering can be fine or coarse, and created in a pattern that complements the lines of the stock and forearm. Shotguns rarely have checkering on the metal, only the wood.

Choke

A constriction in the muzzle of a shotgun intended to constrict and control the pattern of the shot. A properly-choked shotgun delivers a uniform pattern of shot that ensures a broken clay pigeon or dead game bird at a known distance. Choke is relative. The appropriate amount of choke for a woodcock at 20 yards is inadequate for a duck at 50. The appropriate choke for the duck would be far too tight, and result in either a clean miss or disintegrated woodcock at 20 yards.

Clay pigeon

A domed disk made of pitch and clay used for shotgun practice and competition. The disk shape produces a small amount of lift, making the flight of the disk less like that of a thrown ball. Sporting clays uses disks of several sizes while skeet and trap use uniform targets. The clay birds in the sporting clays game can be throw faster or farther, or rolled along the ground to simulate a running rabbit.

Color case hardening

An attractive form of carburizing, surface hardening of mild steel. The color-case is thinner than non-color case hardening, and offers little in the way of protection from corrosion.

Comb

The top surface of the stock, where the face rests during firing. The height and angle of the comb can aid or hinder proper aiming of the shotgun. A smooth and rounded curve of the comb makes firing more comfortable.

Damascus

A type of barrel produced by heat-laminating bars of hard and soft steel together. The bars are folded and re-folded several times. The laminated bars are then wrapped in a spiral around a mandrel and heat-laminated

along the spiral edges. The resulting tube is then turned into a barrel. A Damascus barrel was an early and viable attempt to make harder barrels where harder steel could not be worked with soft cutting tools. Damascus barrels are prone to weakening by corrosion along the edges of the soft and hard steel laminates. A Damascus barrel should never be fired with smokeless powder shells.

Dram Equivalent

Black powder was measured for shotguns in a volute called a dram. Over time, shooters worked out loads that were most effective on particular game, and settled on particular combinations. A load might be 1-¼ ounces of shot and 3-¾ drams of powder. (A very effective duck load, then and now.) When smokeless powder was used, the new stuff was more powerful, and thus less was needed. To rate the new powder to the old, the “dram equivalent” was invented. A charge of smokeless that pushed that 1-¼ ounces of shot to the same velocity as 3-¾ drams of black powder was deemed a “3-¾ dram equivalent” load. The dram equivalent system is like democracy, in that is it “the least effective system ever devised, except for all the others.”

Drilling

noun – A multi-barrel shotgun where one of the barrels is a rifle-caliber and rifled bore. A drilling strictly speaking is a three-barreled firearm (from the German three; “Drei”), with one or two of the barrels being rifle calibers. European hunting is not like hunting in the U.S., with different seasons. The game is owned by the landowner, and you pay for what you shoot. If you are out for pheasant, and a boar happens by, you cannot expect the 1-⅛ oz of #4 shot to make any impression on him. But with a rifle barrel, you would switch the selector and bag the boar, ***verb*** – With a rotating, sharpened cutting tool, creating a circular hole into or through an object.

Driven game

Hunting where the shooter stays in one location, and the game is forced past by “beaters.” The beaters travel towards the shooter, making noise and driving the game ahead of them.

Ejector

The part that tosses the fired empty hull out of the mechanism. The ejector on a repeating shotgun is usually, but not always, a fixed post or hook that the rim of the shell strikes as it is being extracted from the chamber. On a single-shot or double, the extractor and ejector are the same part, differing only by the status of the shell and whether it is an automatic ejector or not.

Elevated rib

A rib raised above the barrel more so than standard practice. It may be pitched down towards the muzzle to create the result of the pattern striking above the bead.

Engraving

Creating art on a shotgun by cutting game scenes or patterns into the steel with sharpened tools called gravers. Poorly-done engraving is ugly and impossible to justify. Well-done engraving can cost more than the base shotgun it is on.

Extractor

A hook or sliding or pivoting platform that lifts the shell out of the chamber. On a double, the extractor is also the ejector, changing its function only after the shell had been fired. On a pump or auto, the ejector and extractor are separate parts.

Fence

The rear exterior of the action, supporting the standing breech.

File

noun **-** A hardened steel tool with a serrated surface used to remove wood or metal form the surface of an object. ***verb*** **-** To use a file to remove wood or metal from a surface, to smooth or even a surface.

Firing pin

A pin that transmits the energy from the hammer to the primer. The firing pin passes through the bolt or standing breech (of a single or double) and when struck by the hammer fires the cartridge.

Flintlock

An ignition system whereby a flint was held in the hammer, and struck a hardened plate called the frizzen. The sparks showering off the frizzen ignited the powder in the part, thus igniting the main powder charge.

Folded crimp

A crimp to contain the shot that is formed by folding the end of the tube inwards, locking the shot inside the hull. The loaded folded-crimp shell is shorter than a rolled-crimp shell because the unfolded crimp shell must remain within the length of the chamber restrictions. The danger lies in that an unknowing shooter might measure a shell, determine that is it loaded shorter than the markings on their barrel, and fire it. An example would be a shell referred to as a “3-inch” 12-gauge. Loaded, it is shorter than 2-¾ inches overall length. A shooter measuring it might assume (incorrectly) that it would be safe to fire it in a 2-¾-inch chambered shotgun. On firing, the folded crimp of the 3-inch shell would unfold out into the forcing cone, restricting the path of the shot, and greatly increasing pressures.

Forcing Cone

The transition of the inner diameter of the barrel from the chamber to the bore. Shotguns made before plastic wads were available had short and steep forcing cones to control the orientation of the cardboard over-shot wad. With plastic wads and folded crimp shells, the short and steep forcing cone was not needed. A lengthened forcing cone creates less shot deformities, and reduces recoil.

Forearm

The part of the shotgun forward of the action that is grasped by the off hand. On a double or self-loading shotgun, the forearm is stationary. On a pump, the forearm reciprocates under the action of the shooter and removes the fired cartridge to replace it with a fresh one.

Gauge

The measure of a shotgun bore. The traditional measurement was the number of uniform lead spheres that could be made from a pound of lead. A 12-gauge thus was a sphere of lead weighing 16/12ths of an ounce, or 583 grains. A 16-gauge was a 1-ounce ball, a 20 was 16/20th of an ounce, and

so on. The accepted measurement now of a 12-gauge is .729 inches. The .410 is a bore measurement and not a gauge.

Glass ball

A type of target that enjoyed a brief popularity in the middle to end of the 19th century. The hollow glass ball could be filled with feather or powder to produce a marked effect when shattered. Glass balls were replaced by clay pigeons, a cylindrical airfoil that had better flight.

Hammer guns

In the evolution of shotguns from the flintlock to the percussion cap, hammers were essential. When shotguns moved to cartridge-firing breechloaders, external hammers became an old-fashioned practice. In some instances a shotgun with external hammers can be an affectation, such as in Cowboy Action Shooting. As a defensive shotgun, a hammer gun has visible safety settings.

Hammerless guns

When shotguns moved to cartridges, the external hammers weren't needed, and for protection from the elements the hammers moved inside. While not actually hammerless, the “hammerless” shotgun has its hammer enclosed in the receiver. A side-by-side or over-under has hammers, they are simply hidden. Likewise with a pump or automatic.

Hand-detachable locks

When double shotguns started to have internal hammers in the mid- to late-19th century, the locks could still be at the mercies of black powder. Rather than require the disassembly of the whole action to clean the locks, some makers like Westley Richards produced shotguns with detachable locks. The mechanism on its mounting plate could be extracted through the bottom of the receiver for cleaning or safe storage. If you thought a “regular” London Best shotgun cost money, detachable locks were even more expensive.

Hanger

A part attached to the barrel that is used to secure the barrel to the magazine tube of a pump or auto-loading shotgun.

Hinge pin

The rod in a double that the barrels rotate on when opening and closing. Many over-unders do not use a hinge pin, but have cylindrical pivot points, known as trunnions, built into their assembly.

Inertia weight

A weight built into the trigger mechanism of double shotguns that re-sets the mechanism after the first shot is fired, allowing the trigger to fire the second barrel once the trigger has be released and pulled a second time.

Inertial trigger

A trigger mechanism that uses a weight to re-set the trigger to the second barrel after firing the first.

Locks

The hammers, springs and firing pins of a single or double shotgun. In a sidelock the locks are on a plate that is secured to the side of the stock and action. In a boxlock the locks are contained within the action itself.

Lump

The lug or lugs underneath a double shotgun that the lever locks into to latch the action shut.

Muzzle

The front end of a barrel, where the shot exits.

Muzzleloader

A shotgun that has to be loaded from the muzzle, and not through the breech. Breechloaders utilize cartridges, while muzzleloaders usually use loose powder, wads and shot, each of which must be introduced in turn in order to load.

Nitro Proved

When the use of smokeless powder became an obvious inevitability, the proof houses developed a proof system to test shotguns with the use of smokeless. A shotgun that has passed the smokeless tests is said to be

“Nitro proved.” Some black-powder era and Damascus shotguns have been tested and proved with Nitro. These markings should be considered great increases in the value of a collectors piece, but not at all an indication they are safe to shoot with smokeless powder. Again, do not shoot any Damascus-barreled shotgun with smokeless powder, regardless of how it is marked.

Paradox

A combination rifle/shotgun, where the shotgun-gauge firearm has rifling in the last few inches of the bore. The rifling was fast enough in twist to stabilize a ball or conical bullet, but not so fast or tall as to adversely change the shot pattern. Sold to the hunter or adventurer who would be traveling to far-off parts of the British Empire, and who felt the need for a versatile firearm.

Pattern

The distribution of the pellets. Patterns are usually checked at a known distance and when delivering a known percentage of shot into a certain-sized circle are then rated. When tested at 40 yards, a barrel that keeps 65 percent or more of its pellets in a 30-inch circle is call a Full choke. The uniformity of the pattern can be as important as its percentage. A uniform pattern is more useful than one that has sparse and concentrated patches in it. Patterns are tested either on paper or on large steel plates.

Percussion

The last step in muzzleloading firearms was the ignition system “percussion.” Utilizing an impact-sensitive compound help in a small foil or copper cup called a cap. The cap rested on the nipple, and the impact of the hammer ignited the cap, in turn igniting the powder.

Plated

A shotgun or barrel that has had its pattern checked on a large steel plate brushed or rolled with white paint. The size and uniformity of the pattern at various distances can be checked and rated. **Also**: Plated, a term for the application of nickel, chromium or other protective surfaces on the exterior of steel.

Practical competition

A shotgun competition that does not involve the use of clay pigeons, but rather falling steel plates. Rather than walk from shooting stand to shooting stand, the shooter engages an array of targets from several shooting boxes or a shooting lane. The targets must all be knocked down, and the fastest shooter finished wins.

Power Factor

One measure of the power of a cartridge. PF is momentum, where the weight in grains of the shot or slug is multiplied by the velocity in feet per second. Commonly used in practical competition shooting.

Proof marks

A symbol or letter and number combination marked on a shotgun after it has been proofed. Many countries require that all shotguns produced be tested by a central authority for strength and dimensional uniformity. Shotguns that pass are marked, and the mark is called a proof or proof mark. In some cases every time a shotgun is sold it must be tested, or it must be tested if the proof laws have changed since the last sale. The U.S. depends on the manufacturer's fear of lawsuits to ensure properly-constructed shotguns.

Reaming

Enlarging an existing hole without changing its orientation. While a drill can ream, a reamer cannot drill.

Receiver

The section of the shotgun that holds the firing mechanism, and to which the barrel and stock are attached. In magazine-fed shotguns, the receiver holds the parts to feed each shell into the chamber.

Recoil pad

A rubber or synthetic pad that replaces the buttplate, intended to soften the impact of recoil. A rubber recoil pad can also prevent the butt from sliding under recoil, which would preclude a fast follow-up shot.

Regulate

To adjust the barrels of a double so the patterns of each barrel are centered on the point of aim at a known distance.

Reload

An empty cartridge that has been cleaned and had the consumed components (shot, wads, powder and primer) replaced. Also the act of replacing fired empties with fresh ammunition in a shotgun.

Rifling

Spiral grooves cut into the bore of a shotgun barrel to impart spin to a single projectile. Rifling improves accuracy of a slug, but does not allow shot loads to be used.

Rifled choke tube

A screw-in choke tube that has its interior rifled. The short section of rifling improves accuracy with slugs, but does not allow shot toads to be used.

Rolled crimp

A crimp formed by rolling the edge of the hull inwards to lock the payload in place. When shotguns shells were paper tubes, a roll crimp was standard. The shot was kept in place by a cardboard wad. The wad was a convenient place to mark the shot size and dram equivalent. Modern plastic hulls are loaded with a folded crimp with one exception: slug loads. The slug loads are loaded with a roll crimp for two reasons. One, the roll crimp creates more resistance to the initial movement of the slug, allowing the powder to burn completely. The slower powders many slugs are loaded with must face this resistance in order to burn completely and efficiently. Second, the roll crimp instantly identifies the shell as one being loaded with a slug.

Sabot

From the French for shoe. Both the bore-filling spacers around a smaller-diameter slug, and the term for the shell itself.

Sear

The piece of the trigger assembly that holds the cocked hammer. The sear can be a part of the trigger, or an intermediate part that the trigger must act on in order to release the hammer.

Selective ejector

A selective ejector “decides” whether to toss the cartridge out or not based on whether the barrel has been fired or not. When the hammer says cocked, the ejector acts as an extractor and merely lifts the unfired shell high enough that it can be plucked out for unloading. When the barrel has been fired, the ejector launches the fired shell free of the chamber. Some ejectors can be set to eject, or set to only extract even when fired. On a shotgun such settings don't matter much, but on a double rifle to be used for dangerous game, it can be important. After shooting something big, tough and nasty, if it isn't already dead it will he looking around for the source of its problems. The “ping” of the ejecting brass can be just the signal of where to charge.

Self-contained cartridge

The early term for a cartridge or shell, see: Cartridge.

Single trigger

A double shotgun where the one trigger can be used to fire each barrel in turn. A selective single trigger allows the shooter to pre-set which barrel will be fired first.

Sling

A carrying strap clipped to the shotgun. Unlike a sling used in rifle shooting, a sling for shotguns is not meant as an aiming aid.

Slug

The slang term for a shell loaded with a single projectile. Early slug loads were round-ball loads. Later slugs have been formed for better aerodynamics.

Smokeless Powder

A gunpowder formed by creating a combustible form of nitrated cellulose. More compact and powerful than black powder, it suffers less from

humidity. It produces much less smoke and the resulting residue is not hygroscopic. The use of smokeless powder in a shotgun designed for black powder is dangerous and should never be done.

Soldering

Joining two or more pieces of metal with a layer of dissimilar metal containing lead, silver or other metals.

Sporting clays

Meant to simulate hunting situations, sporting Clays has been called “golf with a gun.” Unlike skeet or trap, where the course is laid out on level and open ground, the Sporting Clays course is set in brush, woods or other hunting-like situations. Many SC courses change the course annually or several times a season, presenting the shooters with new situations. Unlike skeet and trap, with unvarying target direction, velocity and angles, the SC course can present the shooter with shots from every angle.

Standing breech

The rear face of the opened action of a side-by-side or over-under, where the bases of the cartridges rest when the action is closed.

Stock

The part of the shotgun behind the action, that the shooter places against his shoulder to fire. Made of wood or plastic, the stock aids aiming and allows the use of cartridges more powerful than could be fired without the support of the body.

Striker

Another term for firing pin. Usually used to refer to the firing pins on doubles.

Table

The flats of the side-by-side that the barrels come down to and contact when it is closed.

Top lever

The lever on top of a shotgun, single or double, that opens the mechanism.

Traps

The machines that throw clay pigeons. A trap machine or thrower uses a pivoting arm to hurl the bird out of the trap house. In the game of skeet, the machines are stationary and throw the birds on a known path. In American trap the machine wobbles and the birds are thrown within in a small but known cone. In international skeet and international trap, the shooter is faced with a covered trench containing many machines, any of which may launch a bird on a wide cone. The international games are not for the faint of heart.

Trigger

The lever or levers on the bottom of the shotgun that must be pulled to fire the shotgun.

Turkey

A large bird native to North America. The domestic turkey is on a level of “smarts” on par with or less than the domestic chicken. The wild turkey is smart, wary and cautious to the point of paranoia. Benjamin Franklin even suggested it as the official bird of the new country.

Turkey hunting

Unlike other birds, turkeys are rarely taken on the wing. The typical method is for the camouflage-clad hunter to sit and wail, and lure a bird close by using a turkey call. By letting the male, the Tom, think there is an interested female, or a potential competitor, in his territory, the hunter lures the bird close enough for a shot.

Wad

The paper, plastic, cardboard or felt used to separate the powder from the shot. Also the cup that contains the shot in a modern shotgun shell. Modern wads protect pellets from deformation, tightening the effects of a choke. A shotgun choked for use with old shells with only cardboard and felt to separate the powder from the shot can deliver much tighter patterns when fired with shells using a plastic wad.

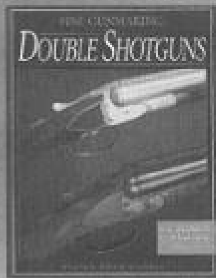
Welding

Joining two or more pieces by melting their edges and introducing additional metal of a similar or identical composition.

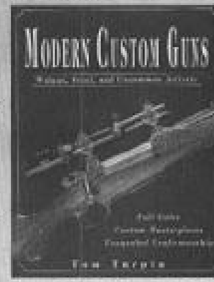
Wrist

The portion of the stock immediately to the rear of the action, which the firing hand grasps. Also called on some stocks the pistol grip. An English style stock has a wrist without a pistol grip. A combat style shotgun has a pistol grip without a wrist

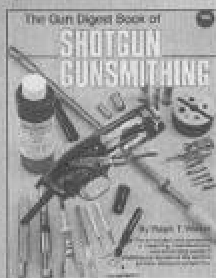
AN EXPERT LOOK AT



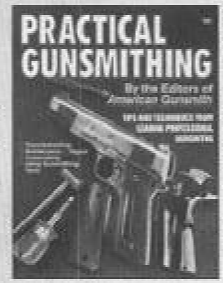
Fine Gunmaking: Double Shotguns
by Steven Dodd Hughes
Here is an in-depth look at what goes into creating some of the world's finest custom shotguns. One of the top custom gunmakers in the United States invites you into his shop, giving you a feel for the craftsmanship and detail that goes into a truly great shotgun.
Hardcover • 8-1/2 x 11 • 160 pages
63 b&w photos • 53 color photos
Item# FGSS • $34.95



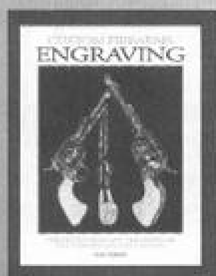
Modern Custom Guns
Walnut, Steel, and Uncommon Artistry
by Tom Turpin
Rifles, shotguns and handguns from today's most talented artists are discussed in fine detail in this handsome hardcover volume. From exquisite engraving to the beauty of exotic woods, the mystique of today's custom guns is expertly detailed. Includes full-color photos of many of the world's most beautiful firearms.
Hardcover • 8-1/2 x 11 • 208 pages
225 color photos
Item# MCG01 • $49.95



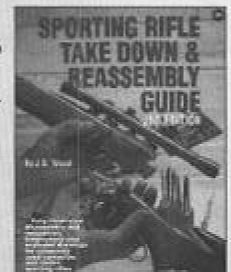
The Gun Digest™ Book of Shotgun Gunsmithing
by Ralph T. Walker
One of the nation's premier shotgun specialists explains the principles and practices of repairing, individualizing and making modern scatter-guns more accurate. Never-before covered information!
Softcover • 8-1/2 x 11 • 256 pages
410 b&w photos
Item# SHSM • $16.95



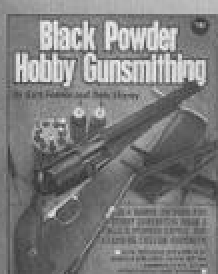
Practical Gunsmithing
by The Editors of American Gunsmith
Written with the home gunsmith, professional and hobbyist all in mind. American Gunsmith editors troubleshoot common problems and methods to correct them, and outline technical skills for bench work, choosing tools and measuring instruments and much more.
Softcover • 8-1/4 x 10-11/16
256 pages
500 b&w photos
Item# PG • $19.95



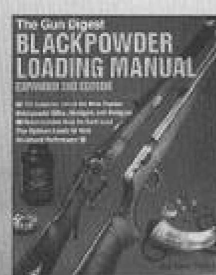
Custom Firearms Engraving
by Tom Turpin
Here is a broad and comprehensive look at the world of firearms engraving that covers exquisite examples of highly decorated handguns, rifles, shotguns and other firearms, as well as knives. More than 75 master engravers are represented with over 200 stunning photos in four-color presentation. Includes an up-to-date Engravers Directory so you can contact the craftsman of your choice.
Hardcover • 8-1/2 x 11
208 pages • 200 color photos
Item# CFE • $49.95



Sporting Rifle Take Down & Reassembly Guide, *2nd Edition*
by J.B. Wood
Numbered, exploded or isometric drawings and user-friendly text explain each step of the takedown and reassembly process for 52 popular centerfire and rimfire rifles. This "must-have" reference includes labeled parts for convenient reference. More than 2,000 b&w photos.
Softcover • 8-1/4 x 10-11/16
480 pages
4,000+ b&w photos
Item# SRAT • $19.95



Black Powder Hobby Gunsmithing
by Sam Fadala and Dale Storey
Keep busy with projects for all levels of competence, from kitchen table through home workshop, all the way to the academic. Step-by-step tutorials on building from kits and a resource directory make the grade.
Softcover • 8-1/4 x 10-11/16
256 pages
440 b&w photos
Item# BHG • $18.95



The Gun Digest™ Blackpowder Loading Manual
3rd Edition
by Sam Fadala
Worth its price just for the load data on 158 firearms alone, Sam Fadala crafts instructive articles and a loading tutorial into the must-have book blackpowder shooters have been craving. All-new information with expanded sections.
Softcover • 8-1/4 x 10-11/16
368 pages
390 b&w photos
Item# BPL3 • $19.95